PTP 600 Series

User Guide

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Important safety information

⚠ WARNING

To prevent loss of life or physical injury, observe the safety guidelines in this section.

Power lines

Exercise extreme care when installing antennas near power lines.

Working at heights

Exercise extreme care when working at heights.

Grounding and protective earth

The Outdoor Unit (ODU) must be properly grounded to protect against lightning. It is the user's responsibility to install the equipment in accordance with national regulations. In the USA, follow Section 810 of the *National Electric Code, ANSI/NFPA No.70-1984* (USA). In Canada, follow Section 54 of the *Canadian Electrical Code*. These codes describe correct installation procedures for grounding the outdoor unit, mast, lead-in wire and discharge unit, size of grounding conductors and connection requirements for grounding electrodes. Other regulations may apply in different countries and therefore it is recommended that installation of the outdoor unit be contracted to a professional installer.

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PIDU Plus

The supplied Power Indoor Plus (PIDU Plus PTP 300/500/600 Series) is used to power the ODU. Failure to use the Motorola supplied PIDU could result in equipment damage and will invalidate the safety certification and may cause a safety hazard.

Powering down before servicing

Always power down and unplug the equipment before servicing.

Cable measuring card

A cable measuring card must NEVER be used at the ODU end connected to power from the PIDU Plus. It must only be used at the bottom of the mast with a multimeter. This is because the PIDU Plus voltage exceeds the limit allowed in some countries for safe handling in wet conditions and therefore may create a safety hazard.

Non-Motorola power supply

Safety may be compromised if a different power supply is used than the one supplied by Motorola as part of the system.

Alternative DC supplies

When using alternative DC supplies (via the PIDU Plus DC in terminals), such as battery-backed DC power source, the supply MUST comply with the following requirements:

- The voltage and polarity is correct and is applied to the correct terminals in the PIDU Plus.
- The power source is rated as SELV.
- The power source is rated to supply at least 1A continuously.
- The power source cannot provide more than the Energy Hazard Limit as defined by IEC/EN/UL6090, Clause 2.5, Limited Power (The Energy Hazard Limit is 240VA).

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Primary disconnect device

The main power supply is the primary disconnect device.

External cables

Safety may be compromised if outdoor rated cables are not used for connections that will be exposed to the weather.

Grounding PTP-SYNC

In order to meet the safety requirements for deployment in Australia and New Zealand (AS/NZS 60950-1), the PTP-SYNC unit, if deployed, must be grounded to a Protective Ground in accordance with Local Electrical Regulations.

RF exposure near the antenna

Strong radio frequency (RF) fields will be present close to the antenna when the transmitter is on. Always mute the transmitter before undertaking maintenance activities in front of the antenna.

Minimum separation distances

Install the ODUs so as to provide and maintain the minimum separation distances from all persons.

The minimum separation distances for each frequency variant are specified in Calculated distances and power compliance margins on page 4-100.

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Contents

Important safety information ..... **i**
Power lines i
Working at heights i
Grounding and protective earth i
PIDU Plus ii
Powering down before servicing ii
Cable measuring card ii
Non-Motorola power supply ii
Alternative DC supplies ii
Primary disconnect device iii
External cables iii
Grounding PTP-SYNC iii
RF exposure near the antenna iii
Minimum separation distances iii
About This User Guide **1**
Revision history 2
Version information 2
General information 3
Purpose 3
Cross references 3
Text conventions 4
Contacting Motorola 5
Feedback 5
Motorola Point-to-Point 5
Wireless Broadband Technical Support telephone numbers 5
Reporting problems 7

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Repair and service 7
Warranty 8
Security advice 9
Warnings, cautions, and notes 10
Warnings 10
Cautions 10
Notes 10
Caring for the environment 11
In EU countries 11
In non-EU countries 11
Chapter 1 Product description 1-1
Overview 1-2
Key features 1-2
Typical deployment 1-3
Product variants 1-4
System components 1-6
Outdoor unit (ODU) 1-7
ODU description 1-7
ODU interfaces 1-8
Connectorized ODU antenna interfaces 1-9
Mounting brackets 1-9
Network connection 1-10
Powered indoor unit (PIDU Plus) 1-11
PIDU Plus description 1-11
PIDU Plus interfaces 1-11
Redundancy and alternative powering configurations 1-13
Remote LEDs and recovery switch 1-15
PIDU Plus maximum cable lengths 1-15
Cabling and lightning protection 1-16
PTP and lightning protection 1-16
Outdoor connections 1-16
Indoor connections 1-17
Cable grounding kits 1-17
Lightning protection units (LPUs) 1-18

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PTP-SYNC unit 1-20
PTP-SYNC unit description 1-20
PTP-SYNC unit interfaces 1-21
PTP-SYNC maximum cable lengths 1-22
Wireless operation 1-23
Time division duplexing 1-23
Link mode optimization 1-25
Link symmetry 1-25
OFDM and channel bandwidth 1-26
Spectrum management 1-27
Adaptive modulation 1-28
MIMO 1-29
Intelligent dynamic frequency selection 1-29
Radar avoidance 1-30
Security 1-31
Region codes 1-31
PTP networks 1-32
TDD synchronization 1-33
Ethernet bridging 1-36
Customer network 1-36
Management network 1-37
Back-to-back links 1-39
Protocol model 1-39
Telecoms circuits 1-41
Lowest telecoms modulation mode 1-41
Fixed frequency operation 1-41
Further reading 1-42
System management 1-43
Management agent 1-43
Web server 1-43
RADIUS authentication 1-46
SNMP 1-46
SNMPv3 security 1-47
System logging (syslog) 1-51

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AES license 1-52
Critical security parameters 1-53
Capacity upgrades 1-53
Software upgrade 1-54
Recovery mode 1-54
FIPS 140-2 1-56
FIPS 140-2 capability 1-56
FIPS 140-2 mode 1-58
Chapter 2 Planning considerations 2-1
Spectrum planning 2-2
Selecting a license for the region code 2-2
Frequency selection 2-3
Radar avoidance 2-4
Variable channel bandwidth operation 2-5
Site planning 2-6
ODU site selection 2-6
PIDU Plus site selection 2-6
PTP-SYNC site selection 2-7
Wind loading 2-7
Link planning 2-10
Range and obstacles 2-10
PTP Link Planner 2-10
Using PTP Link Planner for synchronized networks 2-11
Path loss considerations 2-11
When to use the connectorized PTP 600 antennas 2-13
System threshold, output power and link loss 2-13
Grounding and lightning protection 2-14
Standards 2-14
Lightning protection zones 2-14
General protection requirements 2-15
Protection requirements for a mast or tower installation 2-17
Protection requirements for a wall installation 2-20
Protection requirements on a high rise building 2-22
Configuration options for TDD synchronization 2-27

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TDD synchronization configurations supported 2-27
Single link configuration with UltraSync 2-28
Single link configuration with PTP-SYNC 2-29
Cluster with PTP-SYNC and GPS receiver 2-30
Cluster with PTP-SYNC and no GPS receiver 2-31
Mounting options for the PTP-SYNC GPS receiver 2-32
GPS receiver location requirements 2-32
Mounting the GPS receiver module on the equipment building 2-33
Mounting the GPS receiver module on a metal tower or mast 2-34
Data network planning 2-35
Management mode 2-35
VLAN membership 2-35
Priority for management traffic 2-35
IP interface 2-36
Quality of service for bridged Ethernet traffic 2-36
Back to back links 2-36
‘Green Ethernet’ switches 2-36
Security planning 2-37
Planning for HTTPS/TLS operation 2-37
Planning for FIPS 140-2 operation 2-38
Planning for SNMP operation 2-39
Planning for SNMPv3 operation 2-41
Chapter 3 Legal information 3-1
Motorola Inc. end user license agreement 3-2
Definitions 3-2
Grant of license 3-2
Conditions of use 3-3
Title and restrictions 3-4
Confidentiality 3-4
Right to use Motorola’s name 3-5
Transfer 3-5
Updates 3-5
Maintenance 3-5
Disclaimer 3-6

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Limitation of liability 3-6
U.S. government 3-7
Term of license 3-7
Governing law 3-7
Assignment 3-7
Survival of provisions 3-8
Entire agreement 3-8
Third party software 3-8
Hardware warranty 3-23
Limit of liability 3-24
Chapter 4 Reference information 4-1
Installation inventories 4-2
Inventory for standard installations 4-2
Inventory for connectorized bridge installations 4-5
Inventory for UltraSync installations 4-7
Inventory for PTP-SYNC installations 4-8
Inventory for GPS receiver installations 4-9
Inventory for E1 or T1 installations 4-11
ODU specifications 4-12
Dimensions and weight 4-12
Environmental 4-13
PIDU Plus specifications 4-14
Dimensions and weight 4-14
Environmental 4-14
Electrical 4-15
Cable and connector specifications 4-16
Outdoor CAT5e cable (drop cable) 4-16
Outdoor connectors and glands – ODU or LPU 4-16
Outdoor connectors and glands – Trimble GPS 4-17
Indoor CAT5e cable 4-17
Antenna specifications 4-18
Antenna selection criteria 4-18
PTP 54600 FCC antenna restrictions 4-18
PTP 58600 FCC antenna restrictions 4-21

4Gon www.4Gon.co.uk info@4gon.co.uk Tel: +44 (0)1245 808195 Fax: +44 (0)1245 808299

PTP-SYNC specifications 4-26
Dimensions and weight 4-26
Environmental 4-26
Electrical 4-27
Timing inputs 4-27
GPS/SYNC IN pinout description 4-28
Wireless specifications 4-29
General wireless specifications 4-29
Licenses and region codes 4-36
Available spectrum settings 4-44
System threshold, output power and link loss 4-62
Data network specifications 4-76
Ethernet interfaces 4-76
System management data 4-77
SNMPv3 default configuration (MIB-based) 4-77
VACM default configuration 4-78
RADIUS protocols and attributes 4-79
Email alerts 4-81
Event notification messages 4-82
Safety compliance 4-89
Electrical safety compliance 4-89
Electromagnetic compliance 4-90
EMC immunity compliance 4-90
Radio certifications 4-91
Compliance with regulations 4-91
Regulatory issues with connectorized units 4-94
Electromagnetic energy 4-98
Examples of regulatory limits 4-102
Notifications 4-107
PTP 25600 regulatory compliance 4-107
PTP 49600 regulatory compliance 4-108
PTP 54600 regulatory compliance 4-108
PTP 58600 regulatory compliance 4-110
PTP 59600 regulatory compliance 4-113

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Data rate calculations 4-114
Data rate defined 4-114
Calculation procedure and example 4-115
Data throughput capacity 4-117
Range adjustment curves 4-128
Chapter 5 Installation 5-1
Preparing for standard installations 5-2
Preparing and connecting cables 5-3
Preparing the drop cable 5-3
Grounding the drop cable 5-5
Connecting the drop cable to an ODU or LPU 5-9
Disconnecting the drop cable from an ODU or LPU 5-11
Installing the ODU and top LPU 5-12
Checking the mounting bracket and pole 5-12
Selecting a mounting option for the top LPU 5-14
Checking that it is safe to hoist the ODU 5-15
Mounting the ODU and top LPU 5-16
Installing the drop cable and ground cables 5-18
Connecting the ODU to the top LPU 5-19
Installing and grounding the drop cable on a mast 5-20
Installing and grounding the drop cable at building entry 5-22
Installing the PIDU Plus 5-24
Mounting the PIDU Plus 5-24
Connecting the PIDU Plus to the ODU cable 5-24
Forming a drip loop 5-26
Preparing the PIDU Plus to LAN cable 5-27
Dressing the PIDU Plus cables 5-27
Installing a connectorized ODU and antenna 5-28
Preparing for connectorized installations 5-28
Mounting the connectorized ODU 5-28
Mounting the antenna 5-29
Connecting the ODU and antenna 5-29
Weatherproofing the antenna connections 5-29
Grounding the antenna cables 5-30

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Fixing the antenna cables 5-33
Installing an UltraSync GPS receiver 5-34
Preparing for UltraSync installation 5-34
Connecting the UltraSync unit 5-35
Checking the complete UltraSync unit installation 5-36
Installing a PTP-SYNC unit 5-37
Preparing for PTP-SYNC installation 5-37
Mounting the PTP-SYNC unit 5-38
Connecting up the PTP-SYNC unit 5-39
Powering up the PTP-SYNC installation 5-41
Installing a GPS receiver for PTP-SYNC 5-42
Preparing for GPS receiver installation 5-42
Mounting the GPS receiver 5-42
Connecting the drop cable to the GPS receiver 5-43
Grounding the GPS receiver drop cable 5-47
Mounting the LPU and connecting the GPS receiver 5-48
Installing an E1 or T1 interface 5-49
Preparing for E1 or T1 installation 5-49
Preparing the E1 or T1 drop cable 5-49
Installing the E1 or T1 top LPU 5-49
Connecting the ODU to the E1 or T1 top LPU 5-50
Installing the E1 or T1 drop and ground cables 5-50
Installing the E1 or T1 patch panel 5-51
Testing the E1/T1 installation 5-53
Chapter 6 Configuration and alignment 6-1
Task 1: Configure IP and Ethernet interfaces 6-2
Configuring the management PC 6-2
Connecting to the PC and powering up 6-4
Logging into the web interface 6-4
Updating the IP and Ethernet configuration 6-6
Reconnecting to the management PC 6-11
Task 2: Install license keys 6-12
Checking licensed capabilities 6-12
Generating a new license key 6-14

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Entering a new license key 6-15
Task 3: Upgrade software version 6-16
Checking the installed software version 6-16
Saving the system configuration 6-17
Upgrading to a new software version 6-18
Task 4: Configure security 6-21
Configuring AES encryption 6-22
Configuring HTTPS/TLS 6-24
Task 5: Configure password policy 6-36
Configuring user accounts 6-36
Configuring password complexity 6-39
Task 6: Set passwords 6-42
Creating or updating identity-based users 6-42
Changing own user password 6-44
Protecting access to the summary and status pages 6-45
Task 7: Configure wireless interface 6-46
Updating the system configuration 6-46
Updating quality of service 6-48
Updating wireless configuration 6-50
Configuring telecoms circuits 6-68
Task 8: Align antennas 6-71
Starting up the units 6-71
Using the graphical installation option 6-72
Using the ODU installation tones 6-73
Aligning the units 6-74
Observing behavior during alignment 6-75
Aligning connectorized antennas 6-76
Task 9: Disarm after alignment 6-78
Disarming the unit 6-78
Task 10: Check link performance 6-82
Adjusting power settings 6-82
Task 11: Connect link to the network 6-83
Connecting to the network 6-83
Setting the real-time clock 6-84

4Gon www.4Gon.co.uk info@4gon.co.uk Tel: +44 (0)1245 808195 Fax: +44 (0)1245 808299

Task 12: Configure RADIUS 6-87
Configuring RADIUS authentication 6-87
Task 13: Set up SNMP agent 6-90
Configuring generation of SNMPv3 notifications 6-90
Configuring generation of SNMPv1/2c notifications 6-99
Task 14: Configure alarms and messages 6-104
Configuring generation of diagnostics alarms 6-104
Configuring generation of email messages 6-106
Task 15: Configure syslog 6-108
Configuring system logging (syslog) 6-108
Task 16: Configure remote access 6-110
Configuring HTTP, Telnet and TFTP access 6-110
Chapter 7 Operation 7-1
Web-based management 7-2
Accessing the web interface 7-2
Menu navigation bar 7-3
Using the menu options 7-4
Viewing the system summary 7-6
Viewing the system status 7-11
Managing spectrum 7-22
Configuring spectrum usage at the master 7-22
Viewing spectrum usage at the slave 7-25
Interpreting the spectrum management plots 7-27
Viewing the active channel history 7-36
Viewing historic spectrum management metrics 7-37
Remote software upgrade by TFTP 7-38
Managing security 7-40
Exiting FIPS 140-2 mode 7-40
Zeroizing critical security parameters 7-40
Managing performance 7-41
Checking system statistics 7-41
Resetting system histograms and counters 7-48
Checking detailed counters 7-48
Using the diagnostics plotter 7-52

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Downloading diagnostic data 7-54
Rebooting the unit 7-56
Chapter 8 Troubleshooting 8-1
Test link end hardware 8-2
Power LED is off 8-5
Power LED is flashing 8-6
Ethernet LED did not flash 10 times 8-7
No Ethernet activity 8-9
Irregular Ethernet activity 8-9
Connection is not 1000 BaseT 8-9
Test Ethernet packet errors reported by ODU 8-10
Test Ethernet packet errors reported by managed switch or router 8-10
Test ping packet loss 8-11
Test resistance at the PIDU Plus end of the drop cable 8-12
Test UltraSync GPS receiver 8-15
Test radio link 8-16
No activity 8-16
Some activity 8-17
Lightning strike 8-18
PTP-SYNC fault finding guide 8-19
LEDs do not illuminate 8-19
The ‘STATUS’ LED does not blink 8-19
The ‘ODU’ LED does not illuminate within 90 seconds of power-up 8-19
The ‘GPS’ LED does not illuminate or blink on clustered PTP-SYNC units 8-20
Using recovery mode 8-21
Entering recovery mode 8-21
Selecting a recovery option 8-22
Upgrading software image 8-24
Resetting IP & Ethernet configuration 8-25
Erasing configuration 8-26
Rebooting the unit 8-27
Restoring the configuration file 8-28
Glossary I
Index III

4Gon www.4Gon.co.uk info@4gon.co.uk Tel: +44 (0)1245 808195 Fax: +44 (0)1245 808299

List of Figures

Figure 1-1 Typical PTP 600 Series bridge deployment 1-4
Figure 1-2 PTP 600 Series integrated ODU (front and rear views) 1-7
Figure 1-3 PTP 600 Series connectorized ODU (front and rear views) 1-7
Figure 1-4 ODU interfaces 1-8
Figure 1-5 Connectorized ODU antenna interfaces 1-9
Figure 1-6 Mod record label 1-10
Figure 1-7 PIDU Plus interfaces 1-11
Figure 1-8 PIDU Plus power input 1-12
Figure 1-9 Relationship between DC voltage and cable length 1-13
Figure 1-10 External DC supply only 1-14
Figure 1-11 External DC supply and AC supply 1-14
Figure 1-12 External DC supply and redundant AC supply 1-14
Figure 1-13 Remote LED and recovery switch wiring 1-15
Figure 1-14 Cable grounding kit for 1/4” and 3/8” cable 1-17
Figure 1-15 LPU double end kit 1-18
Figure 1-16 LPU single end kit 1-19
Figure 1-17 PTP-SYNC kit 1-20
Figure 1-18 PTP-SYNC front panel 1-21
Figure 1-19 TDD cycle 1-24
Figure 1-20 Protocol layers between Ethernet and wireless interfaces 1-40
Figure 1-21 Protocol layers between external interfaces and the management agent 1-40
Figure 1-22 Tamper evident label on side edge of ODU 1-57
Figure 1-23 Tamper evident label on top edge of ODU 1-57
Figure 1-24 FIPS 140-2 hardware version identification 1-57
Figure 1-25 Indication of FIPS 140-2 capability 1-58
Figure 1-26 FIPS operational mode alarm 1-59

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Figure 2-1 RTTT channel avoidance example (5.8 GHz UK) 2-4
Figure 2-2 Rolling sphere method to determine the lightning protection zones 2-15
Figure 2-3 Grounding cable minimum bend radius and angle 2-17
Figure 2-4 Grounding and lightning protection on mast or tower 2-18
Figure 2-5 Grounding and lightning protection on mast or tower (with E1 or T1) 2-19
Figure 2-6 Grounding and lightning protection on wall 2-20
Figure 2-7 Grounding and lightning protection on wall (with E1 or T1) 2-21
Figure 2-8 Grounding and lightning protection on building 2-23
Figure 2-9 Grounding and lightning protection inside high building 2-24
Figure 2-10 Grounding in a high rise building – building steel not available 2-25
Figure 2-11 Grounding in a high rise building – building steel available 2-26
Figure 2-12 TDD synchronization configuration – standalone with UltraSync 2-28
Figure 2-13 TDD synchronization configuration – single link with PTP-SYNC 2-29
Figure 2-14 TDD synchronization configuration – cluster with PTP-SYNC and GPS 2-30
Figure 2-15 TDD synchronization configuration – cluster with PTP-SYNC and no GPS 2-31
Figure 2-16 Grounding and lightning protection for GPS receiver on building 2-33
Figure 2-17 Grounding and lightning protection for GPS receiver on tower or mast 2-34
Figure 4-1 UltraSync unit 4-7
Figure 4-2 PTP 25600 BRS band channel assignments 4-45
Figure 4-3 PTP 45600 available spectrum in 30 MHz channel bandwidth (RC 23) 4-46
Figure 4-4 PTP 45600 available spectrum in 20 MHz channel bandwidth (RC 23) 4-47
Figure 4-5 PTP 45600 available spectrum in 15 MHz channel bandwidth (RC 23) 4-47
Figure 4-6 PTP 45600 available spectrum in 10 MHz channel bandwidth (RC 23) 4-48
Figure 4-7 PTP 45600 available spectrum in 5 MHz channel bandwidth (RC 23) 4-48
Figure 4-8 PTP 45600 available spectrum in 20 MHz channel bandwidth (RC 24) 4-49
Figure 4-9 PTP 45600 available spectrum in 10 MHz channel bandwidth (RC 24) 4-49
Figure 4-10 PTP 48600 available spectrum in 20 MHz channel bandwidth (RC 15 and 23) 4-50
Figure 4-11 PTP 48600 available spectrum in 15 MHz channel bandwidth (RC 15 and 23) 4-50
Figure 4-12 PTP 48600 available spectrum in the 10 MHz channel bandwidth (RC 15 and 23) 4-51
Figure 4-13 PTP 48600 available spectrum in 5 MHz channel bandwidth (RC 15 and 23) 4-51
Figure 4-14 PTP 48600 available spectrum in the 20 MHz channel bandwidth (RC 24) 4-52
Figure 4-15 PTP 48600 available spectrum in 10 MHz channel bandwidth (RC 24) 4-52
Figure 4-16 PTP 49600 available spectrum in 20 MHz channel bandwidth 4-52
Figure 4-17 PTP 49600 available spectrum in the 10 MHz channel bandwidth 4-53

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Figure 4-18 PTP 49600 available spectrum in the 5 MHz channel bandwidth 4-53
Figure 4-19 PTP 54600 available spectrum in 30 MHz channel bandwidth 4-54
Figure 4-20 PTP 54600 available spectrum in 15 MHz channel bandwidth 4-54
Figure 4-21 PTP 54600 available spectrum in 10 MHz channel bandwidth 4-55
Figure 4-22 PTP 54600 available spectrum in 5 MHz channel bandwidth 4-55
Figure 4-23 PTP 58600 available spectrum in 30 MHz channel bandwidth 4-56
Figure 4-24 PTP 58600 available spectrum in 15 MHz channel bandwidth 4-56
Figure 4-25 PTP 58600 available spectrum in the 10 MHz channel bandwidth 4-57
Figure 4-26 PTP 58600 available spectrum in 5 MHz channel bandwidth 4-57
Figure 4-27 PTP 59600 available spectrum in 30 MHz channel bandwidth 4-59
Figure 4-28 PTP 59600 available spectrum in 15 MHz channel bandwidth 4-60
Figure 4-29 PTP 59600 available spectrum in 10 MHz channel bandwidth 4-60
Figure 4-30 PTP 59600 available spectrum in 5 MHz channel bandwidth 4-61
Figure 4-31 PTP 600 range adjustment for data rates, curve A..... 4-130
Figure 4-32 PTP 600 range adjustment for data rates, curve B..... 4-130
Figure 4-33 PTP 600 range adjustment for data rates, curve C 4-131
Figure 4-34 PTP 600 range adjustment for data rates, curve D 4-131
Figure 4-35 PTP 600 range adjustment for data rates, curve E..... 4-132
Figure 4-36 PTP 600 range adjustment for data rates, curve F..... 4-132
Figure 4-37 PTP 600 range adjustment for data rates, curve G 4-133
Figure 4-38 PTP 600 range adjustment for data rates, curve H 4-133
Figure 4-39 PTP 600 range adjustment for data rates, curve K..... 4-134
Figure 4-40 PTP 600 range adjustment for data rates, curve L..... 4-134
Figure 4-41 PTP 600 range adjustment for data rates, curve N 4-135
Figure 4-42 PTP 600 range adjustment for data rates, curve O 4-136
Figure 5-1 Correct cable preparation for drop cable of the supported type..... 5-4
Figure 5-2 Drop cable with RJ45 and gland 5-5
Figure 5-3 Correct and incorrect tightening of cable gland back shell 5-10
Figure 5-4 ODU with mounting bracket and earth bonding leads 5-13
Figure 5-5 Top LPU mounting options 5-14
Figure 5-6 Integral safety loop..... 5-15
Figure 5-7 ODU and top LPU grounding..... 5-19
Figure 5-8 Drop cable grounding on a mast or tower..... 5-21
Figure 5-9 Grounding at building entry 5-22

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Figure 5-10 PIDU Plus drip loop configuration 5-26
Figure 5-11 Forming a drip loop 5-29
Figure 5-12 Weatherproofing the antenna connections 5-30
Figure 5-13 Grounding points for antenna cables 5-31
Figure 5-14 Lightning arrestor mounting 5-32
Figure 5-15 Polyphaser assembly 5-33
Figure 5-16 UltraSync unit connections 5-35
Figure 5-17 UltraSync deployment diagram 5-35
Figure 5-18 UltraSync unit complete installation 5-36
Figure 5-19 Rack mount securing screws for PTP-SYNC 5-38
Figure 5-20 PTP-SYNC mounted on a wall 5-38
Figure 5-21 RJ45 and Trimble connector pins 5-44
Figure 5-22 ODU and top LPU grounding for E1 or T1 5-50
Figure 5-23 E1/T1 port on ODU 5-50
Figure 5-24 E1 or T1 patch panel 5-51
Figure 5-25 RJ45 pin connections from drop cable to telecoms channels (T568B) 5-51
Figure 5-26 Example of a Balun 5-52
Figure 6-1 IP configuration on the PC 6-3
Figure 6-2 Internet Protocol (TCP/IP) Properties page 6-3
Figure 6-3 LAN Configuration page 6-6
Figure 6-4 LAN Configuration page with VLAN enabled 6-7
Figure 6-5 LAN Configuration page with auto-negotiation disabled 6-7
Figure 6-6 Configuration Reboot page 6-11
Figure 6-7 Configuration Reboot page - Ethernet auto negotiation disabled 6-11
Figure 6-8 Software License Key page 6-13
Figure 6-9 Reboot Wireless Unit dialog 6-15
Figure 6-10 Software Version in System Status page 6-17
Figure 6-11 Save & Restore Configuration page 6-18
Figure 6-12 Software Upgrade page 6-19
Figure 6-13 Software Upgrade Confirmation page 6-20
Figure 6-14 Upgrade Progress Tracker page 6-20
Figure 6-15 Software Upgrade Complete page 6-20
Figure 6-16 System Configuration page 6-23
Figure 6-17 Configuration Reboot dialog 6-23

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Figure 6-18 Security Configuration Wizard page 6-26
Figure 6-19 Step 1: Enter Key of Keys page 6-27
Figure 6-20 Step 2: TLS Private Key and Public Certificate page 6-28
Figure 6-21 Step 3: User Security Banner page 6-29
Figure 6-22 Step 4: Random Number Entropy Input page 6-30
Figure 6-23 Step 5: Enter The Wireless Link Encryption Key page 6-31
Figure 6-24 Step 6: HTTP and Telnet Settings page 6-32
Figure 6-25 Step 7: Commit Security Configuration page 6-34
Figure 6-26 User Accounts page (identity-based user accounts not shown) 6-37
Figure 6-27 Identity-based user accounts 6-43
Figure 6-28 Change Password page (System Administration example) 6-44
Figure 6-29 Webpage Properties page 6-45
Figure 6-30 QoS Configuration page 6-48
Figure 6-31 Current installation summary page 6-50
Figure 6-32 Step 1: Interface Configuration page 6-51
Figure 6-33 Step 1: Interface Configuration page with T1 enabled 6-52
Figure 6-34 Step 2: Wireless Configuration page 6-54
Figure 6-35 Step 2: Wireless Configuration page for connectorized ODUs 6-55
Figure 6-36 Step 2: Wireless Configuration page (extract) for fixed frequency 6-63
Figure 6-37 Step 3: TDD Synchronization page 6-64
Figure 6-38 Step 3: Confirm Installation Configuration page 6-67
Figure 6-39 Reboot confirmation pop up 6-67
Figure 6-40 Telecoms page 6-68
Figure 6-41 Graphical installation page 6-72
Figure 6-42 Disarm Installation page 6-79
Figure 6-43 Optional post-disarm configuration 1 6-80
Figure 6-44 Optional post-disarm configuration 2 6-80
Figure 6-45 Disarm following TDD synchronization 6-81
Figure 6-46 Time Configuration page (SNTP disabled) 6-84
Figure 6-47 Time Configuration page (SNTP enabled) 6-85
Figure 6-48 RADIUS Authentication page 6-88
Figure 6-49 Current SNMP Summary page (when SNMP is disabled) 6-90
Figure 6-50 Step 1: SNMP Configuration page (for SNMPv3) 6-91
Figure 6-51 Step 2: SNMP User Policy Configuration page (for SNMPv3) 6-93

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Figure 6-52 Step 3: SNMP User Accounts Configuration page (for SNMPv3) 6-95
Figure 6-53 Step 4: SNMP Trap Configuration page (for SNMPv3) 6-96
Figure 6-54 Confirm SNMP Configuration page (for SNMPv3) 6-98
Figure 6-55 Step 1: SNMP Configuration page (for SNMPv1/2c) 6-100
Figure 6-56 Step 2: SNMP Trap Configuration page (for SNMPv1/2c) 6-101
Figure 6-57 Confirm SNMP Configuration page (for SNMPv1/2c) 6-103
Figure 6-58 Diagnostic Alarms page 6-105
Figure 6-59 Email Configuration page 6-106
Figure 6-60 Syslog Configuration page 6-108
Figure 6-61 Web-Based Management page 6-110
Figure 7-1 Login page (with username) 7-2
Figure 7-2 Menu navigation bar 7-3
Figure 7-3 System Summary page 7-6
Figure 7-4 Alarm warning triangle 7-7
Figure 7-5 System Status page 7-12
Figure 7-6 Status page - TDD enabled and synchronized 7-20
Figure 7-7 Status page - TDD enabled and not synchronized 7-20
Figure 7-8 Spectrum Management as seen from the Master 7-23
Figure 7-9 Spectrum Management as seen from the Slave 7-26
Figure 7-10 Example spectrum management plot 7-27
Figure 7-11 Spectrum Management Fixed Frequency Mode page 7-30
Figure 7-12 Spectrum Management page with radar avoidance - master 7-32
Figure 7-13 Spectrum Management page with radar avoidance - slave 7-33
Figure 7-14 PTP 25600 example of Spectrum Management page 7-35
Figure 7-15 Active channel history screen 7-36
Figure 7-16 Spectrum management time series plot 7-37
Figure 7-17 System Statistics page 7-42
Figure 7-18 Detailed Counters page 7-49
Figure 7-19 Diagnostic Plotter page 7-53
Figure 7-20 Generate Downloadable Diagnostics page 7-55
Figure 7-21 Reboot Wireless Unit page 7-56
Figure 7-22 Reboot confirmation pop up 7-56
Figure 8-1 Link end hardware test flowchart #1 8-3
Figure 8-2 Link end hardware test flowchart #2 8-4

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Figure 8-3 PTP LPU test points and PWR LED 8-8
Figure 8-4 Drop cable tester (front and back views) 8-13
Figure 8-5 GPS synchronization unit..... 8-15
Figure 8-6 PIDU Plus recovery switch location 8-21
Figure 8-7 Recovery Image Warning page..... 8-22
Figure 8-8 Recovery Options page 8-22

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List of Tables

Table 1-1 PTP 600 Series frequency variants 1-4
Table 1-2 ODU interfaces 1-8
Table 1-3 PIDU Plus interfaces 1-12
Table 1-4 PIDU Plus indicator LEDs 1-12
Table 1-5 PTP-SYNC front panel interfaces 1-21
Table 1-6 PTP-SYNC indicator LEDs 1-22
Table 1-7 Minimum part number suffix for FIPS 140-2 mode 1-56
Table 2-1 Lateral force – metric 2-8
Table 2-2 Lateral force – US 2-8
Table 2-3 HTTPS/TLS security material 2-37
Table 2-4 Permitted character set for SNMPv3 passphrases 2-43
Table 4-1 Standard PTP 600 Series bridge components 4-2
Table 4-2 Connectorized PTP 600 Series bridge components 4-5
Table 4-3 PTP-SYNC installation components 4-8
Table 4-4 GPS receiver installation components 4-9
Table 4-5 Integrated ODU physical specifications 4-12
Table 4-6 Connectorized ODU physical specifications 4-12
Table 4-7 ODU environmental specifications 4-13
Table 4-8 PIDU Plus physical specifications 4-14
Table 4-9 PIDU Plus environmental specifications 4-14
Table 4-10 PIDU Plus electrical specifications 4-15
Table 4-11 Superior Essex cable - available lengths and part numbers 4-16
Table 4-12 Recommended outdoor connectors for ODU and LPU 4-16
Table 4-13 Recommended outdoor connectors for Trimble GPS receiver 4-17
Table 4-14 Allowed antennas for deployment in USA/Canada – 5.4 GHz 4-19
Table 4-15 Allowed antennas for deployment in USA/Canada – 5.8 GHz 4-21

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Table 4-16 Sectored antennas for deployment in USA/Canada – 5.8 GHz 4-25
Table 4-17 PTP-SYNC unit physical specifications 4-26
Table 4-18 PTP-SYNC unit environmental specifications 4-26
Table 4-19 PTP-SYNC unit electrical specifications 4-27
Table 4-20 PTP-SYNC unit timing specifications - GPS/SYNC IN (RJ-45) 4-27
Table 4-21 PTP-SYNC unit timing specifications - 1PPS IN (SMA) 4-28
Table 4-22 GPS/SYNC IN port pinouts 4-28
Table 4-23 PTP 25600 RF specifications 4-29
Table 4-24 PTP 45600 RF specifications 4-30
Table 4-25 PTP 48600 RF specifications 4-31
Table 4-26 PTP 49600 RF specifications 4-32
Table 4-27 PTP 54600 RF specifications 4-33
Table 4-28 PTP 58600 RF specifications 4-34
Table 4-29 PTP 59600 RF specifications 4-35
Table 4-30 PTP 25600 licenses and region codes 4-36
Table 4-31 PTP 45600 licenses and region codes 4-37
Table 4-32 PTP 48600 licenses and region codes 4-37
Table 4-33 PTP 49600 licenses and region codes 4-38
Table 4-34 PTP 54600 licenses and region codes 4-39
Table 4-35 PTP 58600 licenses and region codes 4-40
Table 4-36 PTP 59600 licenses and region codes 4-43
Table 4-37 PTP 25600 channel plan - FCC BRS-EBS Post-Transition Band 4-44
Table 4-38 PTP 58600 band edge Tx power reduction 4-58
Table 4-39 PTP 25600 - IP mode - threshold, power and link loss 4-62
Table 4-40 PTP 25600 - TDM mode - threshold, power and link loss 4-63
Table 4-41 PTP 45600 - IP mode - threshold, power and link loss 4-64
Table 4-42 PTP 45600 - TDM mode - threshold, power and link loss 4-65
Table 4-43 PTP 48600 - IP mode - threshold, power and link loss 4-66
Table 4-44 PTP 48600 - TDM mode - threshold, power and link loss 4-67
Table 4-45 PTP 49600 - IP mode - threshold, power and link loss 4-68
Table 4-46 PTP 49600 - TDM mode - threshold, power and link loss 4-69
Table 4-47 PTP 54600 - IP mode - threshold, power and link loss 4-70
Table 4-48 PTP 54600 - TDM mode - threshold, power and link loss 4-71
Table 4-49 PTP 58600 - IP mode - threshold, power and link loss 4-72

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Table 4-50 PTP 58600 - TDM mode - threshold, power and link loss 4-73
Table 4-51 PTP 59600 - IP mode - threshold, power and link loss 4-74
Table 4-52 PTP 59600 - TDM mode - threshold, power and link loss 4-75
Table 4-53 PTP 600 Ethernet bridging specifications 4-76
Table 4-54 PTP 600 telecoms interface specifications 4-76
Table 4-55 Default SNMPv3 users 4-77
Table 4-56 Default VACM view trees 4-78
Table 4-57 Default data fill for access table 4-78
Table 4-58 Standard RADIUS attributes 4-79
Table 4-59 Vendor specific RADIUS attributes 4-79
Table 4-60 RADIUS protocol interaction for each user role 4-80
Table 4-61 Local log messages 4-83
Table 4-62 Standard log messages 4-83
Table 4-63 SNMPv3 messages 4-83
Table 4-64 Authentication messages 4-84
Table 4-65 Authentication configuration messages 4-84
Table 4-66 Telnet messages 4-85
Table 4-67 TFTP messages 4-85
Table 4-68 RADIUS messages 4-86
Table 4-69 Security configuration messages 4-86
Table 4-70 License key messages 4-88
Table 4-71 Management messages 4-88
Table 4-72 SNTP messages 4-88
Table 4-73 Low resource messages 4-88
Table 4-74 PTP 600 safety compliance specifications 4-89
Table 4-75 EMC emissions compliance 4-90
Table 4-76 EMC radio certifications 4-91
Table 4-77 Normal EIRP limits with operating channel bandwidth 4-94
Table 4-78 Setting maximum transmit power to meet general EIRP limits 4-96
Table 4-79 Cable losses per length 4-97
Table 4-80 Power compliance margins 4-100
Table 4-81 PTP 25600 examples of regulatory limits 4-102
Table 4-82 PTP 45600 examples of regulatory limits 4-102
Table 4-83 PTP 48600 examples of regulatory limits 4-102

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Table 4-84 PTP 49600 examples of regulatory limits 4-103
Table 4-85 PTP 54600 examples of regulatory limits 4-103
Table 4-86 PTP 58600 examples of regulatory limits 4-104
Table 4-87 PTP 59600 examples of regulatory limits 4-106
Table 4-88 Throughput for PTP 600 Full, link symmetry 1:1, link optimization IP 4-118
Table 4-89 Throughput for PTP 600 Full, link symmetry 1:1, link optimization TDM 4-120
Table 4-90 Throughput for PTP 600 Full, link symmetry 2:1, link optimization = IP 4-122
Table 4-91 Throughput for PTP 600 Full, link symmetry 2:1, link optimization = TDM 4-124
Table 4-92 Throughput for PTP 600 Full, link symmetry Adaptive, link optimization = IP 4-126
Table 4-93 Range adjustment characteristics 4-128
Table 5-1 Trimble connector to RJ45 pin mappings 5-43
Table 5-2 E1 or T1 patch panel pin outs 5-52
Table 5-3 Resistance referenced to the E1/T1 source 5-53
Table 6-1 LAN Configuration attributes 6-8
Table 6-2 Capability summary attributes 6-13
Table 6-3 HTTP and Telnet attributes 6-33
Table 6-4 User account management attributes 6-38
Table 6-5 Password complexity configuration attributes 6-40
Table 6-6 Identity-based user accounts attributes 6-43
Table 6-7 System Configuration attributes 6-46
Table 6-8 QoS default settings 6-49
Table 6-9 Step 1: Interface Configuration standard attributes 6-52
Table 6-10 Step 2: Wireless Configuration attributes 6-56
Table 6-11 Step 3: TDD Synchronization attributes 6-65
Table 6-12 Telecoms attributes 6-69
Table 6-13 ODU installation tones 6-73
Table 6-14 Manual clock attributes 6-85
Table 6-15 SNTP clock attributes 6-86
Table 6-16 RADIUS Authentication attributes 6-89
Table 6-17 Step 1: SNMP Configuration attributes (for SNMPv3) 6-92
Table 6-18 Step 2: SNMP User Policy Configuration attributes (for SNMPv3) 6-93
Table 6-19 Step 3: SNMP User Accounts Configuration attributes (for SNMPv3) 6-95
Table 6-20 Step 4: SNMP Trap Configuration attributes (for SNMPv3) 6-97
Table 6-21 Step 1: SNMP Configuration attributes (for SNMPv1/2c) 6-100

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Table 6-22 Step 2: SNMP Trap Configuration attributes (for SNMPv1/2c) 6-102
Table 6-23 Email Configuration attributes 6-107
Table 6-24 Syslog Configuration attributes 6-109
Table 6-25 Web-Based Management attributes 6-111
Table 7-1 Procedures performed from each menu option 7-4
Table 7-2 System Summary attributes 7-6
Table 7-3 Telecoms channel alarm conditions 7-10
Table 7-4 FIPS operational mode alarm values 7-11
Table 7-5 System Status attributes 7-13
Table 7-6 Spectrum Management attributes 7-24
Table 7-7 Channel states represented in the spectrum management plot 7-28
Table 7-8 Key metrics represented in the spectrum management plot 7-29
Table 7-9 Channel states represented in the spectrum management plot (radar avoidance) 7-34
Table 7-10 Interference represented in the time series plot 7-37
Table 7-11 Setting tFTP attributes 7-38
Table 7-12 Monitoring tFTP attributes 7-39
Table 7-13 System Histograms attributes in the System Statistics page 7-43
Table 7-14 Data Port Counter attributes in the System Statistics page 7-45
Table 7-15 Management Port Counter attributes in the System Statistics page 7-45
Table 7-16 Wireless Port Counter attributes in the System Statistics page 7-45
Table 7-17 Other attributes in the System Statistics page 7-47
Table 7-18 Detailed Counters attributes 7-50
Table 8-1 RJ45 cable resistance tests at the PIDU Plus end 8-13
Table 8-2 Clustered PTP-SYNC units - ‘GPS’ LEDs Fault-finding 8-20
Table 8-3 Recovery Options attributes 8-23
Table 8-4 Recovery Options buttons 8-23

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About This User Guide

This guide describes the planning, installation and operation of the Motorola PTP 600 Series of Point-to-Point Wireless Ethernet Bridges. It is intended for use by the link planner, system installer and the end-user IT professional. The users of this guide will require expertise in the following areas:

- Outdoor radio equipment installation
- Network configuration
- Use of web browser for system configuration, monitoring and fault finding

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Revision history

Version information

The following shows the issue status of this document.

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General information

Purpose

Motorola Point-To-Point documents are intended to instruct and assist personnel in the operation, installation and maintenance of the Motorola Point-To-Point equipment and ancillary devices. It is recommended that all personnel engaged in such activities be properly trained.

Motorola disclaims all liability whatsoever, implied or express, for any risk of damage, loss or reduction in system performance arising directly or indirectly out of the failure of the customer, or anyone acting on the customer's behalf, to abide by the instructions, system parameters, or recommendations made in this document.

Cross references

References to external publications are shown in italics. Other cross references, emphasized in blue text in electronic versions, are active links to the references.

This document is divided into numbered chapters that are divided into sections. Sections are not numbered, but are individually named at the top of each page, and are listed in the table of contents.

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Text conventions

The following conventions are used in the Motorola Point-To-Point documents to represent keyboard input text, screen output text and special key sequences.

Input

Characters typed in at the keyboard are shown like this.

Output

Messages, prompts, file listings, directories, utilities, and environmental variables that appear on the screen are shown like this.

Special key sequences

Special key sequences are represented as follows:

CTRL+C	Press the **Ctrl** and **C** keys at the same time.
CTRL+SHIFT+C	Press the **Ctrl**, **Shift**, and **C** keys at the same time.
ALT+F	Press the **Alt** and **F** keys at the same time.
ALT+SHIFT+F11	Press the **Alt**, **Shift**, and **F11** keys at the same time.
|	Press the pipe symbol key.
RETURN or **ENTER**	Press the **Return** or **Enter** key.

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Singapore	64 155 110
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Reporting problems

If any problems are encountered when installing or operating this equipment, follow this procedure to investigate and report:

1. Search this document and the software release notes of supported releases.
2. Visit the Motorola website at http://www.motorola.com/ptp.
3. Ask for assistance from the Motorola product supplier.
4. Gather information from affected units such as:
   - The IP addresses and MAC addresses
   - The software releases
   - The configuration of software features
   - Any available diagnostic downloads
5. Escalate the problem to Motorola as follows:
   - Either: send e-mail to support.ptp@motorola.com
   - Or: call Wireless Broadband Technical Support.

Repair and service

If unit failure is suspected, visit http://www.motorola.com/ptp/support for details of the Return Material Authorization (RMA) process.

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Warranty

Motorola’s standard hardware warranty is for one (1) year from date of shipment from Motorola or a Motorola Point-to-Point Distributor. Motorola warrants that hardware will conform to the relevant published specifications and will be free from material defects in material and workmanship under normal use and service. Motorola shall within this time, at its own option, either repair or replace the defective product within thirty (30) days of receipt of the defective product. Repaired or replaced product will be subject to the original warranty period but not less than thirty (30) days.

To register PTP products or activate warranties, visit http://www.motorola.com/ptp/support.

For warranty assistance, contact the reseller or distributor.

⚠ CAUTION

Using non-Motorola parts for repair could damage the equipment or void warranty. Contact Motorola Warranty and Repair for service and repair instructions.

⚠ CAUTION

Portions of Motorola equipment may be damaged from exposure to electrostatic discharge. Use precautions to prevent damage.

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Security advice

Motorola systems and equipment provide security parameters that can be configured by the operator based on their particular operating environment. Motorola recommends setting and using these parameters following industry recognized security practices. Security aspects to be considered are protecting the confidentiality, integrity, and availability of information and assets. Assets include the ability to communicate, information about the nature of the communications, and information about the parties involved.

In certain instances Motorola makes specific recommendations regarding security practices, however the implementation of these recommendations and final responsibility for the security of the system lies with the operator of the system.

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Warnings, cautions, and notes

The following describes how warnings and cautions are used in this document and in all documents of this Motorola document set.

Warnings

Warnings precede instructions that contain potentially hazardous situations. Warnings are used to alert the reader to possible hazards that could cause loss of life or physical injury. A warning has the following format:

WARNING

Warning text and consequence for not following the instructions in the warning.

Cautions

Cautions precede instructions and are used when there is a possibility of damage to systems, software, or individual items of equipment within a system. However, this damage presents no danger to personnel. A caution has the following format:

CAUTION

Caution text and consequence for not following the instructions in the caution.

Notes

A note means that there is a possibility of an undesirable situation or provides additional information to help the reader understand a topic or concept. A note has the following format:

NOTE

Note text.

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Caring for the environment

The following information describes national or regional requirements for the disposal of Motorola supplied equipment and for the approved disposal of surplus packaging.

In EU countries

The following information is provided to enable regulatory compliance with the European Union (EU) directives identified and any amendments made to these directives when using Motorola equipment in EU countries.



Disposal of Motorola equipment

European Union (EU) Directive 2002/96/EC Waste Electrical and Electronic Equipment (WEEE)

Do not dispose of Motorola equipment in landfill sites. In the EU, Motorola in conjunction with a recycling partner ensures that equipment is collected and recycled according to the requirements of EU environmental law.

Disposal of surplus packaging

Do not dispose of surplus packaging in landfill sites. In the EU, it is the individual recipient’s responsibility to ensure that packaging materials are collected and recycled according to the requirements of EU environmental law.

In non-EU countries

In non-EU countries, dispose of Motorola Networks equipment and all surplus packaging in accordance with national and regional regulations.

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Chapter 1 Product description

This chapter provides a high level description of the PTP 600 product. It describes in general terms the function of the product, the main product variants and typical deployment. It also describes the main hardware components.

The following topics are described in this chapter:

- Overview on page 1-2
- Outdoor unit (ODU) on page 1-7
- Powered indoor unit (PIDU Plus) on page 1-11
- Cabling and lightning protection on page 1-16
- PTP-SYNC unit on page 1-20
- Wireless operation on page 1-23
- Ethernet bridging on page 1-36
- Telecoms circuits on page 1-41
- System management on page 1-43
- FIPS 140-2 on page 1-56

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Overview

Motorola PTP 600 Series Bridge products are designed for Ethernet bridging over point-to-point microwave links in the licensed bands 2.5 GHz, 4.5 GHz, 4.8 GHz and 4.9 GHz, and in the unlicensed bands 5.4 GHz (ETSI Band B), 5.8 GHz (ETSI Band C and FCC ISM band) and 5.9 GHz. Users must ensure that the PTP 600 Series complies with local operating regulations.

The PTP 600 Series acts as a transparent bridge between two segments of the operator's network. In this sense, it can be treated as a virtual wired connection between two points. The PTP 600 Series forwards 802.3 Ethernet packets destined for the other part of the network and filters packets it does not need to forward. The system is transparent to higher-level protocols such as VLANs and Spanning Tree.

Key features

The key features of the PTP 600 Series include:

- True non-line-of-sight (NLOS) operation by using a combination of Orthogonal Frequency Division Multiplexing (OFDM) modulation and Multiple-Input Multiple-Output (MIMO) techniques.
- Wireless connections of up to 200km (124 miles) in near line-of-sight conditions and up to 10km (6 miles) in deep non-line-of-sight conditions.
- Coexistence with other users of the band using a combination of Automatic Transmit Power Control (ATPC), Spectrum Management functionality and Antenna beam shape.
- High link availability, through the use of adaptive modulation techniques that dynamically reduce the data rate in severe or adverse conditions.
- High system gain through high sensitivity antennas for improved signal recovery.
- A radio system that operates on ultra-fast digital signal processors but is controlled by updateable firmware.
- A built-in web server for advanced management capabilities including detailed radio signal diagnosis.
- A range of security features to prevent unauthorized access to data. Optional AES encryption for data transmitted over the wireless, with 128-bit or 256-bit encryption keys. Optional HTTPS/TLS security on the web-based management interface. SNMPv3 with optional AES privacy and SHA1 authentication.

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Benefit of the chosen bands

The PTP 600 operates in bands that offer the dual benefits of high data throughput and good radio propagation characteristics. The wide band of spectrum available is subdivided into several channels such that multiple systems can operate in the vicinity without causing interference to one another.

Similarity to 802.11a devices

The PTP 600 Series products are not 802.11a devices. Although similar, they use different encoding and radio transmission systems from 802.11a. In areas where 802.11a systems are operating, the PTP 600 Series will detect the 802.11a radio signals and choose a clear channel away from any interference.

Avoiding interference from nearby devices

At initialization, the PTP 600 Series monitors the available frequency channels to find a channel that is clear of interference. In operation, the PTP 600 Series continuously monitors the spectrum to ensure it is operating on the cleanest channel.

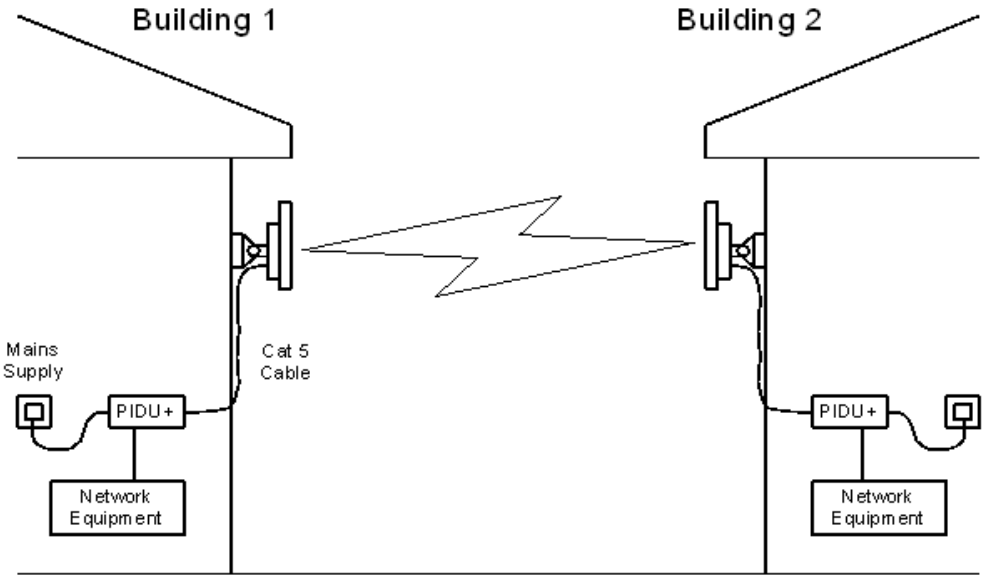
Typical deployment

The PTP 600 Series Bridge consists of an identical pair of units deployed one at each end of the link. The radio link operates on a single frequency channel in each direction using Time Division Duplex (TDD). One unit is deployed as a master and the other as a slave. The master unit takes responsibility for controlling the link in both directions.

The PTP 600 Series Bridge is aimed at a wide range of applications. An example application is an enterprise that has a requirement to connect together the Local Area Network (LAN) of two or more buildings as shown in Figure 1-1.

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Figure 1-1 Typical PTP 600 Series bridge deployment



Product variants

Frequency variants

The PTP 600 Series has been developed to operate within license exempt frequency bands as well as the licensed 2.5 GHz band in the USA. The frequency variants are listed in Table 1-1.

Table 1-1 PTP 600 Series frequency variants

Variant	Region	Frequency Coverage	Variable Channel Bandwidth	Channel Raster
PTP 25600	FCC BRS-EBS Post-Transition Band	2496-2568 MHz	5, 10, 15, 30 MHz	5.5 MHz
		2572-2614 MHz	5, 10, 15, 30 MHz	6 MHz
		2618-2690 MHz	5, 10, 15, 30 MHz	5.5 MHz
PTP 45600	US Federal	4404-4596 MHz	5, 10, 15, 20 MHz	6 MHz
		4404-4596 MHz	30 MHz	10 MHz
	NTIA	4400-4600 MHz	10, 20 MHz	6 MHz

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Variant	Region	Frequency Coverage	Variable Channel Bandwidth	Channel Raster
PTP 48600	US Federal	4710-4940 MHz	5, 10, 15, 20, MHz	5 MHz
	US Federal Extended	4710-5000 MHz	5, 10, 15, 20, MHz	5 MHz
	NTIA	4700-4940 MHz	10, 20 MHz	5 MHz
PTP 49600	USA/Canada Public Safety	4940-4990 MHz	5, 10, 20 MHz	5 MHz
	Hong Kong Public Safety	4900-4950 MHz	5, 10, 20 MHz	5 MHz
PTP 54600	ETSI 5 GHz Band B	5470-5725 MHz	5, 10, 15 MHz	6 MHz
	FCC UNII Band	5470-5725 MHz	30 MHz	10 MHz
PTP 58600	ETSI 5 GHz Band C	5725-5850 MHz	5, 10, 15 MHz	6 MHz
	FCC ISM Band	5725-5850 MHz	30 MHz	10 MHz
PTP 59600	Russia	5825-5925 MHz	5, 10, 15 MHz	6 MHz
			30 MHz	10 MHz
	India	5875-5925 MHz	5, 10, 15 MHz	6 MHz
			30 MHz	10 MHz

NOTE

For PTP 25600, channel widths of 30 MHz are available where allowed by local regulations and subject to some restrictions on channel choice.

For PTP 58600 ETSI 5 GHz Band C, use of the product is only allowed where permitted by country-specific regulations.

Other product variants

The Lite versions have lower data throughput rates then the Full versions.

The PTP 600 outdoor unit (ODU) may be integrated (with its own antenna) or connectorized (with a separate antenna).

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System components

Each end of the link consists of:

- **Outdoor Unit (ODU):** An integrated (or connectorized) outdoor transceiver unit containing all the radio and networking electronics.
- **PIDU Plus:** An indoor connection box containing a mains power supply, status indicators and network connection port.
- **Cabling and lightning protection:** CAT5e cables, grounding cables, connectors and lightning protection units.

A pair of units is normally supplied pre-configured as a link.

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Outdoor unit (ODU)

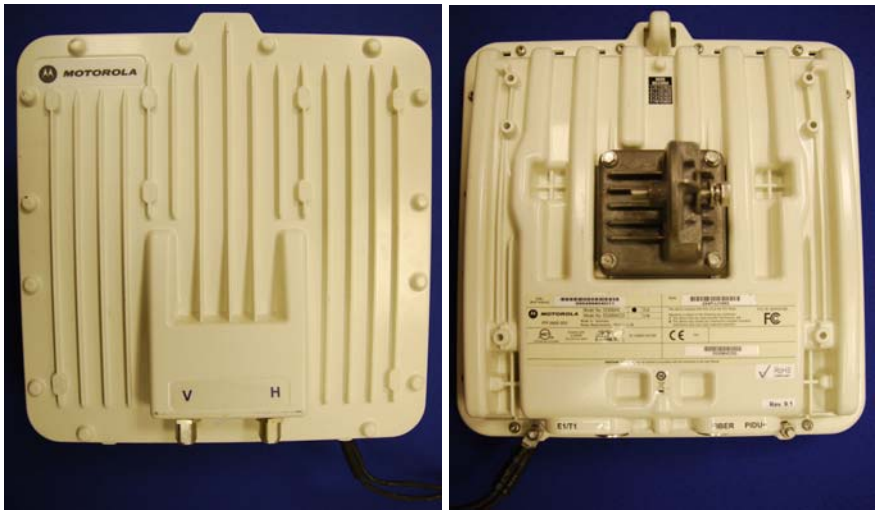
ODU description

The ODU is a self-contained unit that houses both radio and networking electronics. The ODU is supplied in two configurations: integrated (attached to its own flat plate antenna, Figure 1-2) or connectorized (without an antenna, Figure 1-3).

Figure 1-2 PTP 600 Series integrated ODU (front and rear views)



Figure 1-3 PTP 600 Series connectorized ODU (front and rear views)



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Connectorized variant

The connectorized ODU is designed to provide the system integrator and installer with the ability to provide extra capability to cope with very difficult radio links compared to the integrated model. This allows the use of externally mounted antennas that have higher gains than provided by the integrated antenna.

ODU interfaces

The ODU interfaces are illustrated in Figure 1-4 and described in Table 1-2.

Figure 1-4 ODU interfaces



Table 1-2 ODU interfaces

Interface	Function
Ground studs	For grounding the ODU to the mast or building.
E1/T1	RJ45 socket for optional E1 or T1 network connection (not via the PIDU Plus).
SYNC	RJ45 socket for optional connection to UltraSync GPS timing reference source.
FIBER	Fiber optic socket for optional network connection (not via the PIDU Plus) using a 1000BaseSX Fiber Optic cable.
PIDU+	RJ45 socket for connecting to power supply and network via the PIDU Plus.

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Connectorized ODU antenna interfaces

The connectorized ODU also has interfaces to connect to an external antenna (Figure 1-5) via a cable of type LMR100, LMR200, LMR300, LMR400 or LMR600. The ‘V’ interface is for vertical polarization and the ‘H interface is for horizontal polarization.

Figure 1-5 Connectorized ODU antenna interfaces



Mounting brackets

The ODU is supplied with a bracket for mounting it to a pole of 50mm (2”) to 75mm (3”) in diameter.

The bracket allows for adjustment in both azimuth and elevation. The bracket may be split to allow the pole mount section of the bracket to be mounted to the pole first. This allows the installer to take the weight of the unit and secure it, one handed, with a single mounting bolt.

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Network connection

The network connection to a PTP 600 Series is made via a 1000BaseT Ethernet connection. Power is provided to the ODU over the 1000BaseT Ethernet connection using a patented non-standard powering technique.

Very early releases of the PTP 600 Series platform used different powering and connection arrangements. Users of equipment prior to Mod Record 1 should refer to the User Guide shipped with the original equipment. The Mod Record label can be found on the back of the ODU as shown in Figure 1-6.

Figure 1-6 Mod record label



Fiber optic connection

Alternatively, the network connection to a PTP 600 Series can be made using a 1000BaseSX Fiber Optic cable connected directly to the ODU. In this case power is still provided over the 1000BaseT Ethernet connection. In the case of Fiber Optic cable failure the PTP 600 Series will automatically fall back to the copper Ethernet connection (provided the cable length <=100m [330 ft]). PTP 600 Series Optical Interface Upgrade Kits can be obtained from your distributor, reseller or system integrator.

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Powered indoor unit (PIDU Plus)

PIDU Plus description

The PIDU Plus generates the ODU supply voltage from the mains supply (or from an external DC source) and injects this supply voltage into the ODU.

The PIDU Plus is connected to the ODU and network equipment using CAT5e cable with RJ45 connectors. Refer to Cabling and lightning protection on page 1-16.

The ODU for the PTP 600 Series should only be deployed using the supplied PIDU Plus PTP 300/500/600 Series.

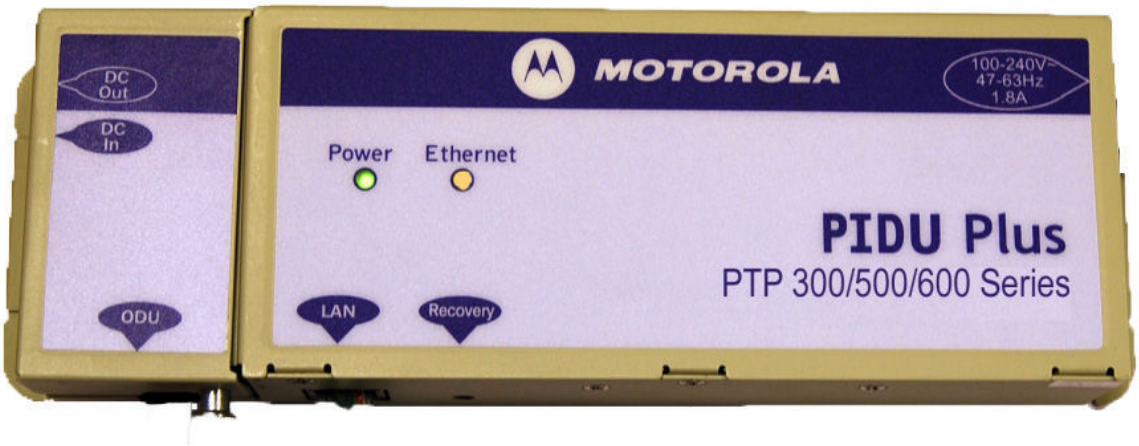
⚠ CAUTION

Care should be taken not to connect equipment other than an ODU, LPU or PTP-SYNC for the PTP 600 Series to a PIDU Plus ODU port, as equipment damage may occur. The PIDU Plus PTP 300/500/600 Series is not interchangeable with the PIDU Plus PTP 400 Series.

PIDU Plus interfaces

The PIDU Plus interfaces are illustrated in Figure 1-7 and described in Table 1-3 and Table 1-4.

Figure 1-7 PIDU Plus interfaces



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Table 1-3 PIDU Plus interfaces

Interface	Function
100-240V 47-63Hz 1.8A	Mains power input (Figure 1-8).
DC In	Alternative DC power supply input. Refer to Redundancy and alternative powering configurations on page 1-13.
DC Out	DC power output to a second PIDU Plus. Used to provide power supply redundancy. Refer to Redundancy and alternative powering configurations on page 1-13.
ODU	RJ45 socket for connecting CAT5e cable to ODU.
LAN	RJ45 socket for connecting CAT5e cable to network.
Recovery	Used to recover the unit from configuration errors or software image corruption.

Table 1-4 PIDU Plus indicator LEDs

Indicator	Function	Description
Power	Off	No power.
	On	PIDU Plus is receiving power.
Ethernet	Off	No Ethernet traffic.
	Blink ten times	Correct start up sequence has occurred.
	Blink randomly	Normal Ethernet traffic.

Figure 1-8 PIDU Plus power input



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Redundancy and alternative powering configurations

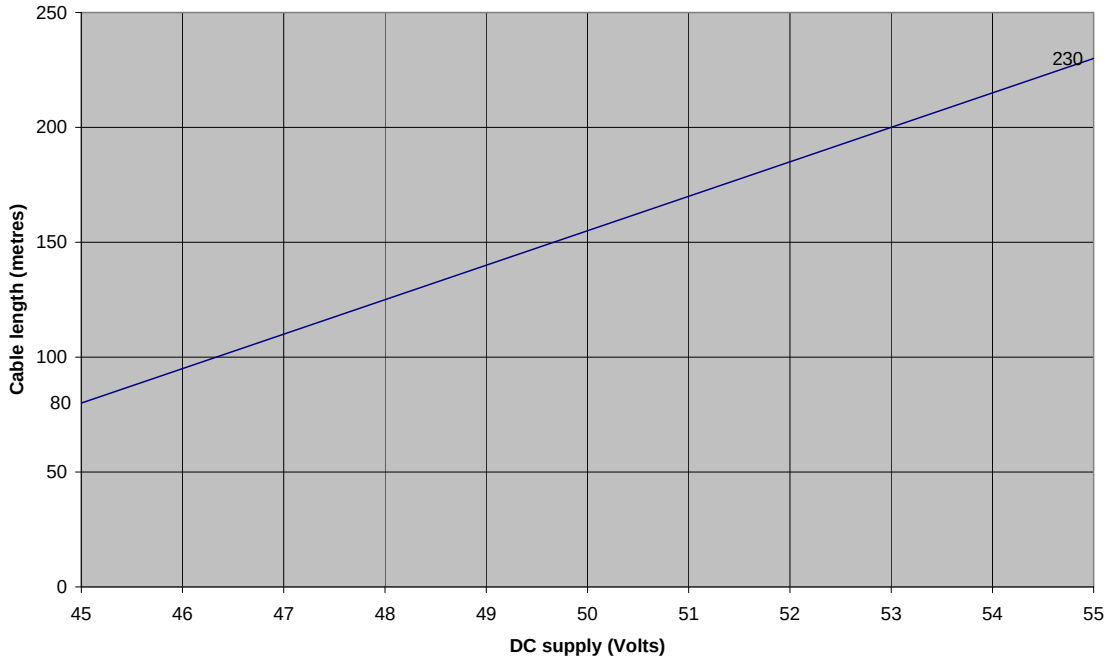
The PTP 600 Series can be powered from an external DC source and can be provided with power supply redundancy as follows:

- External DC supply only (Figure 1-10): This configuration is for use where there is no mains supply.
- External DC supply and AC supply (Figure 1-11): This configuration provides redundancy through the use of mains and DC supply.
- External DC supply and redundant AC Supply (Figure 1-12): This configuration guards against mains failure and failure of the DC output of single PTP 300/500/600 PIDU Plus.

NOTE

The use of DC supplies of less than 55v will reduce the usable distance between the PIDU Plus and ODU (Figure 1-9).

Figure 1-9 Relationship between DC voltage and cable length



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Figure 1-10 External DC supply only

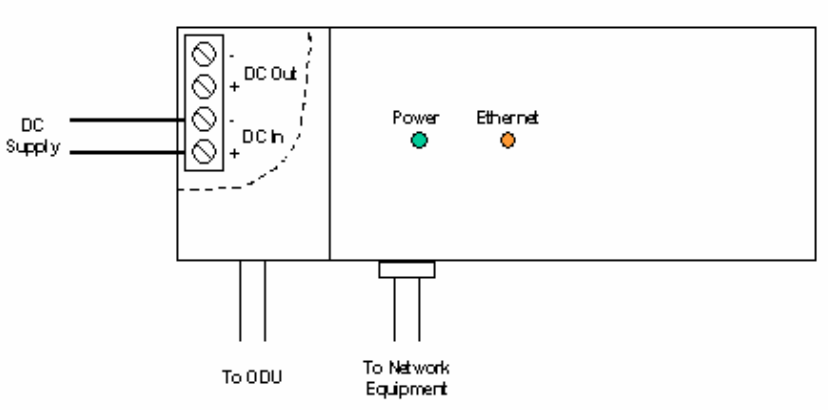


Figure 1-11 External DC supply and AC supply

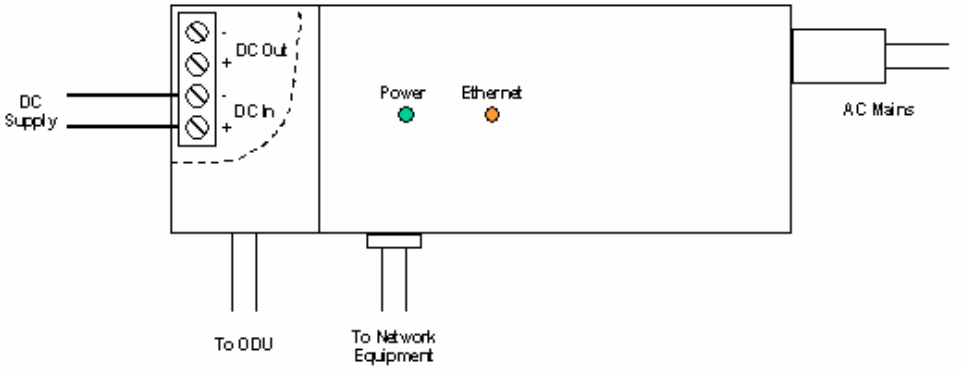
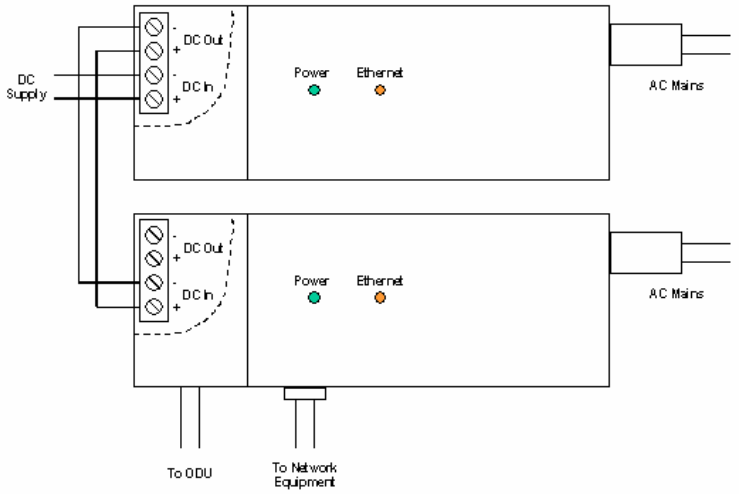


Figure 1-12 External DC supply and redundant AC supply

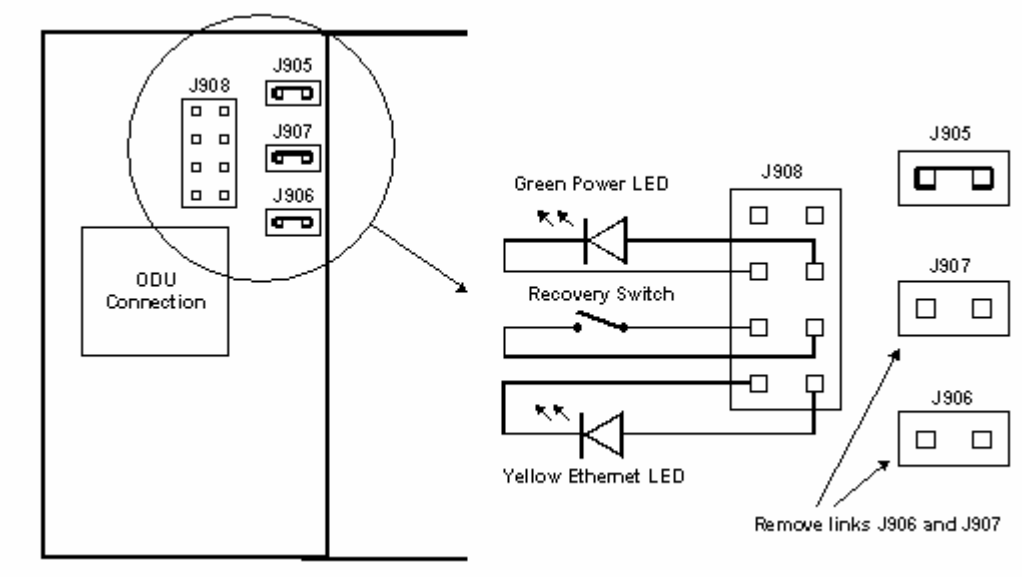


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Remote LEDs and recovery switch

The PIDU Plus provides a facility to connect remote LEDs and Recovery switch allowing the PIDU Plus to be mounted inside an enclosure. At the left hand end of the PIDU Plus under the ODU connection cover can be found a PCB header and three jumpers. Jumpers J906 and J907 should be removed and connection to the remote LEDs and Recovery switch made to J908 as shown in Figure 1-13.

Figure 1-13 Remote LED and recovery switch wiring



PIDU Plus maximum cable lengths

The maximum distance from the ODU to the connected network equipment is 100m (330 ft) when using Ethernet over copper. Powering distances over 100m (330 ft) are only applicable when using a Fiber Optic connection. The maximum power distance is 230m.

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Cabling and lightning protection

The cabling and lightning protection components of a PTP 600 installation are:

- Outdoor drop cable
- Indoor CAT5e cable
- Grounding cables
- Lightning protection units

PTP and lightning protection

The PIDU Plus meets the low level static discharge specifications identified in EMC immunity compliance on page 4-90 but does not provide lightning or surge suppression.

The amount of lightning protection is dependent on regulatory requirements and the end user requirements. The standard ODU for the PTP 600 Series is fitted with surge limiting circuits and other features to minimize the risk of damage due to nearby lightning strikes. To be fully effective, these standard features require some additional equipment to be configured as part of the system installation.

⚠ CAUTION

The PTP 600 Series is not designed to survive direct lightning strikes. For this reason the unit should not be installed as the highest point in a localized area, unless specific precautions are taken. See Grounding and lightning protection on page 2-14.

Outdoor connections

The term ‘drop cable’ refers to the cable that is used for all connections that terminate outside the building, for example, connections between the ODU, LPUs (if installed), GPS receiver (if installed) and the ODU port of the PIDU Plus.

⚠ CAUTION

For outdoor connections, always use Cat5e cable that is gel-filled and shielded with copper-plated steel. This is the only type of outdoor drop cable supported in this application. See Cable and connector specifications on page 4-16.

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Indoor connections

The CAT5e cable that connects the PIDU Plus to the network equipment must meet the screening requirements specified in Cable and connector specifications on page 4-16.

CAUTION

The connected network equipment must feature screened RJ45 connectors and must be connected to ground, otherwise the PIDU Plus will not be grounded.

NOTE

The ODU network connection implements automatic MDI/MDI-X sensing and pair swapping, allowing connection to networking equipment that requires cross-over cables (MDI-X networks) or straight-through cables (MDI Networks).

Cable grounding kits

Drop cables must be grounded at the points specified in Grounding and lightning protection on page 2-14. One cable grounding kit (Figure 1-14) is required for each drop cable grounding point.

Figure 1-14 Cable grounding kit for 1/4” and 3/8” cable



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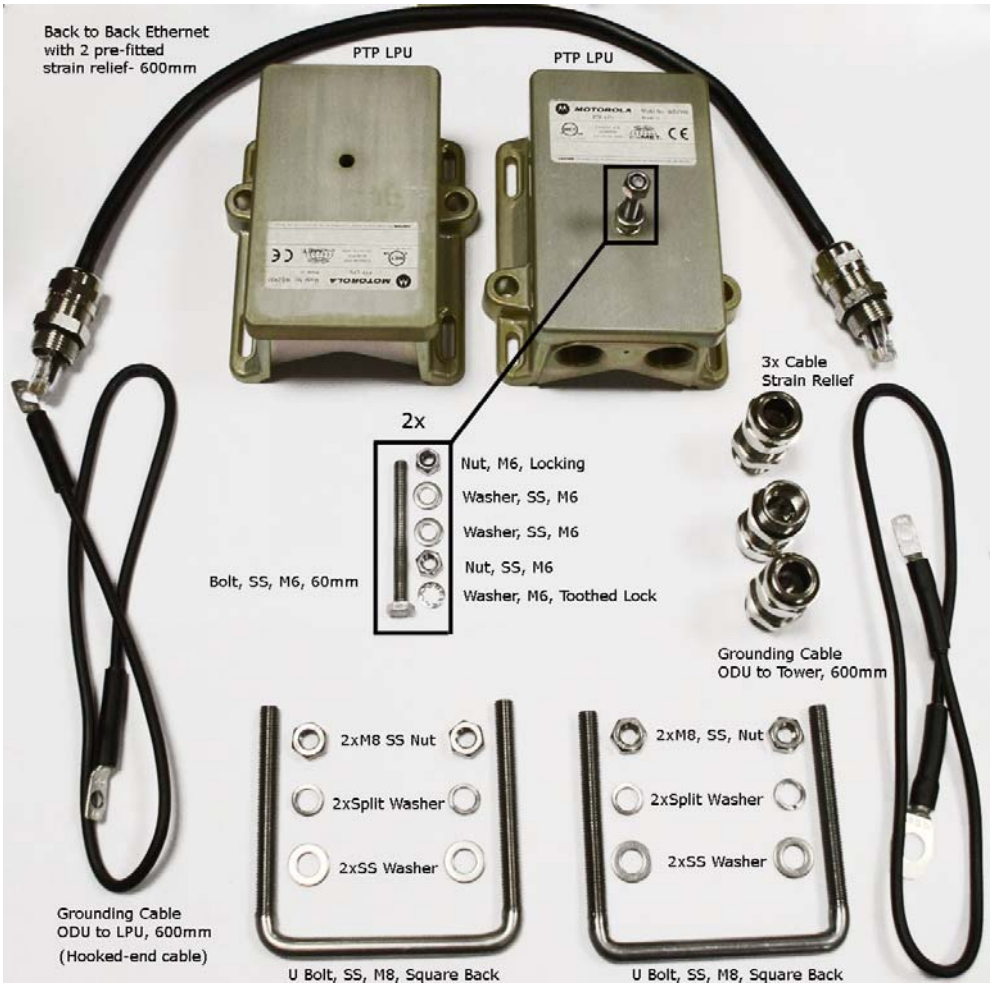
Lightning protection units (LPUs)

Separate Ethernet surge suppressors (lightning protection units) must be installed and grounded. Lightning protection units can be sourced from Motorola Point-to-Point distributors or solutions providers.

LPU double end kit

The LPU double end kit (Figure 1-15) is required for ODU drop cables. One LPU is installed next to the ODU and the other is installed near the building entry point.

Figure 1-15 LPU double end kit

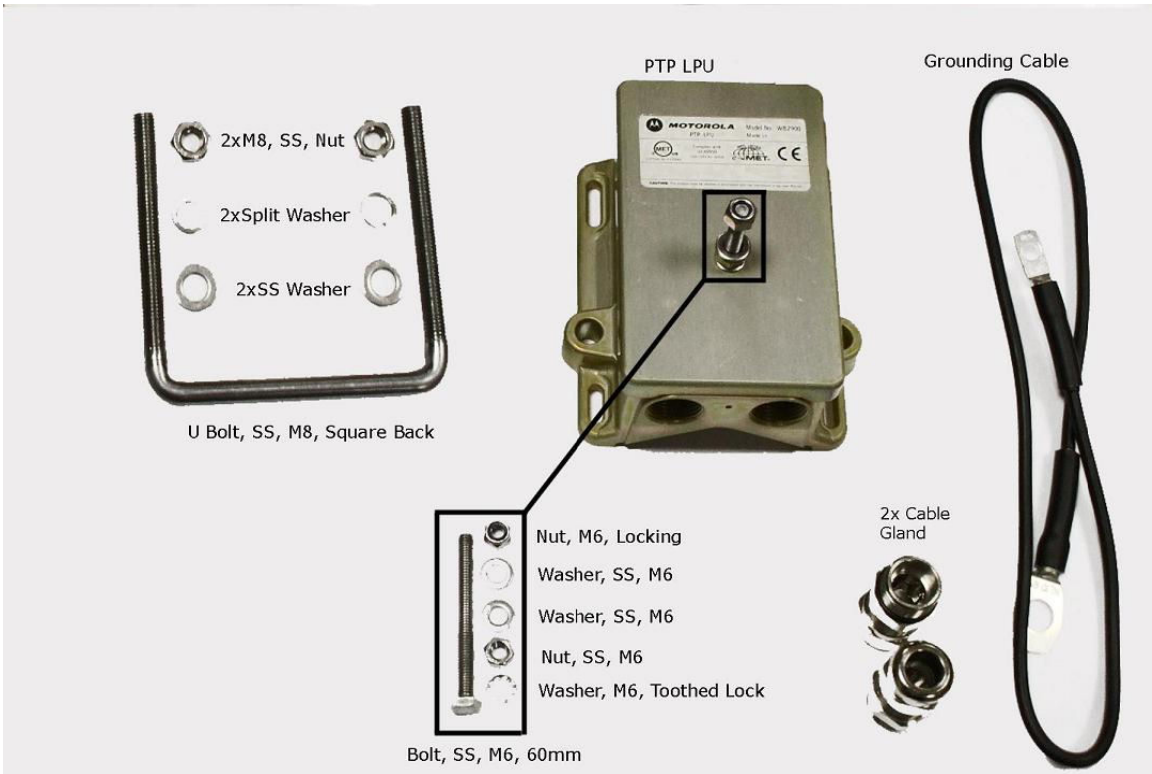


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LPU single end kit

The LPU single end kit (Figure 1-16) is required for GPS drop cables, when GPS is the timing reference source for PTP-SYNC (optional). The LPU is installed near the building entry point.

Figure 1-16 LPU single end kit



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PTP-SYNC unit

PTP-SYNC unit description

The PTP-SYNC unit (Figure 1-17) is an optional component. It is required when TDD synchronization is implemented using PTP-SYNC. It measures the difference between the TDD frame timing and a 1 Hz timing reference, and signals this time difference to the ODU.

For more information on this feature, refer to TDD synchronization on page 1-33.

The PTP-SYNC is a compact indoor unit mounted on a wall or a shelf or (using an optional rack mounting adaptor) in a standard 19 inch rack. It is powered using standard PTP 600 power-over-Ethernet from the PIDU Plus. One PTP-SYNC unit is required for each synchronized link.

Figure 1-17 PTP-SYNC kit



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PTP-SYNC unit interfaces

The PTP-SYNC front panel is illustrated in Figure 1-18. The annotated interfaces are described in Table 1-5.

Figure 1-18 PTP-SYNC front panel

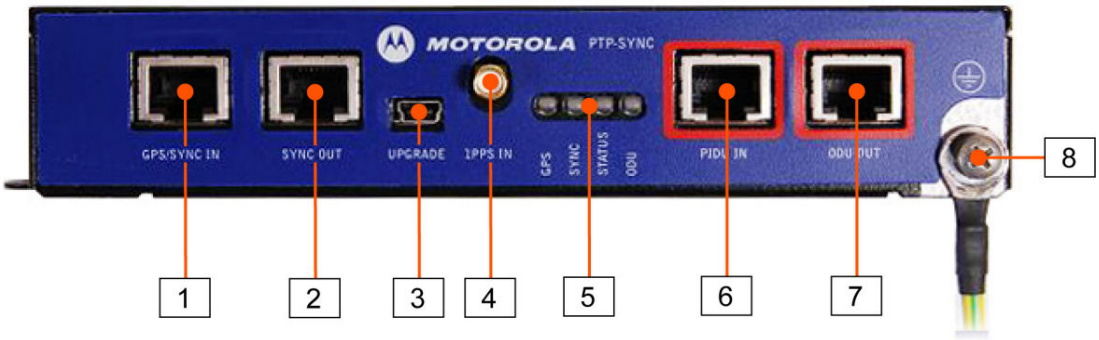


Table 1-5 PTP-SYNC front panel interfaces

Number	Description	Function
1	GPS/SYNC IN	Input from GPS receiver module.
2	SYNC OUT	Output to daisy-chained PTP-SYNC units.
3	USB	Input for software upgrades. Contact Motorola for instructions.
4	1PPS IN	Coaxial alternative to GPS/SYNC IN. Peak input voltage must not exceed 5 V.
5	LED bank	LEDs and their functions are described in Table 1-6.
6	PIDU IN	Input from PIDU Plus.
7	ODU OUT	Output to ODU.
8	Ground stud	For connecting to a ground point.

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Table 1-6 PTP-SYNC indicator LEDs

Indicator	Function	Description
GPS	Off	No GPS satellite data being received at the GPS/SYNC IN port.
	On steady or blink	GPS satellite data being received.
SYNC	Off	No data being received at the SYNC OUT port.
	On steady or blink	Data being received at the SYNC OUT port.
STATUS	Off	No power.
	On steady	Power but no satellite lock.
	Blink	Power and satellite lock at either the GPS/SYNC IN or 1PPS IN port.
ODU	Off	No signal being received from the ODU.
	On	Communication with the ODU is established.

PTP-SYNC maximum cable lengths

The maximum permitted cable lengths for PTP-SYNC installations are:

- ODU to PTP-SYNC: 40 meters (130 ft).
- PTP-SYNC to PIDU Plus: 2 meters (6.5 ft).
- PIDU Plus to network equipment: 20 meters (65 ft).

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Wireless operation

Time division duplexing

TDD cycle

PTP 600 series links operate using Time Division Duplexing (TDD). PTP 600 uses a TDD cycle in which the ODUs alternately transmit and receive TDD bursts. The TDD cycle is illustrated in Figure 1-19. The steps in the cycle are as follows:

1. The TDD master transmits a burst to the TDD slave.
2. A delay occurs as the master-slave burst propagates over the link.
3. The slave receives the burst from the master.
4. A delay occurs as the slave processes the master-slave burst.
5. The slave transmits a burst to the master.
6. A delay occurs as the slave-master burst propagates over the link.
7. The master receives the burst from the slave.
8. The master transmits the next burst to the slave.

TDD frame parameters

The TDD burst duration varies depending on the following:

- Channel bandwidth
- Link range
- Link optimization mode
- Link symmetry
- Offered traffic loading.

The TDD frame duration varies depending on the following:

- TDD burst duration master-slave.
- TDD burst duration slave-master.
- Link range.

The propagation delay in Step 2 is necessarily equal to the propagation delay in Step 6, and is determined solely by the link range. The delay at Step 4 is fixed, except where the link is operated with TDD synchronisation.

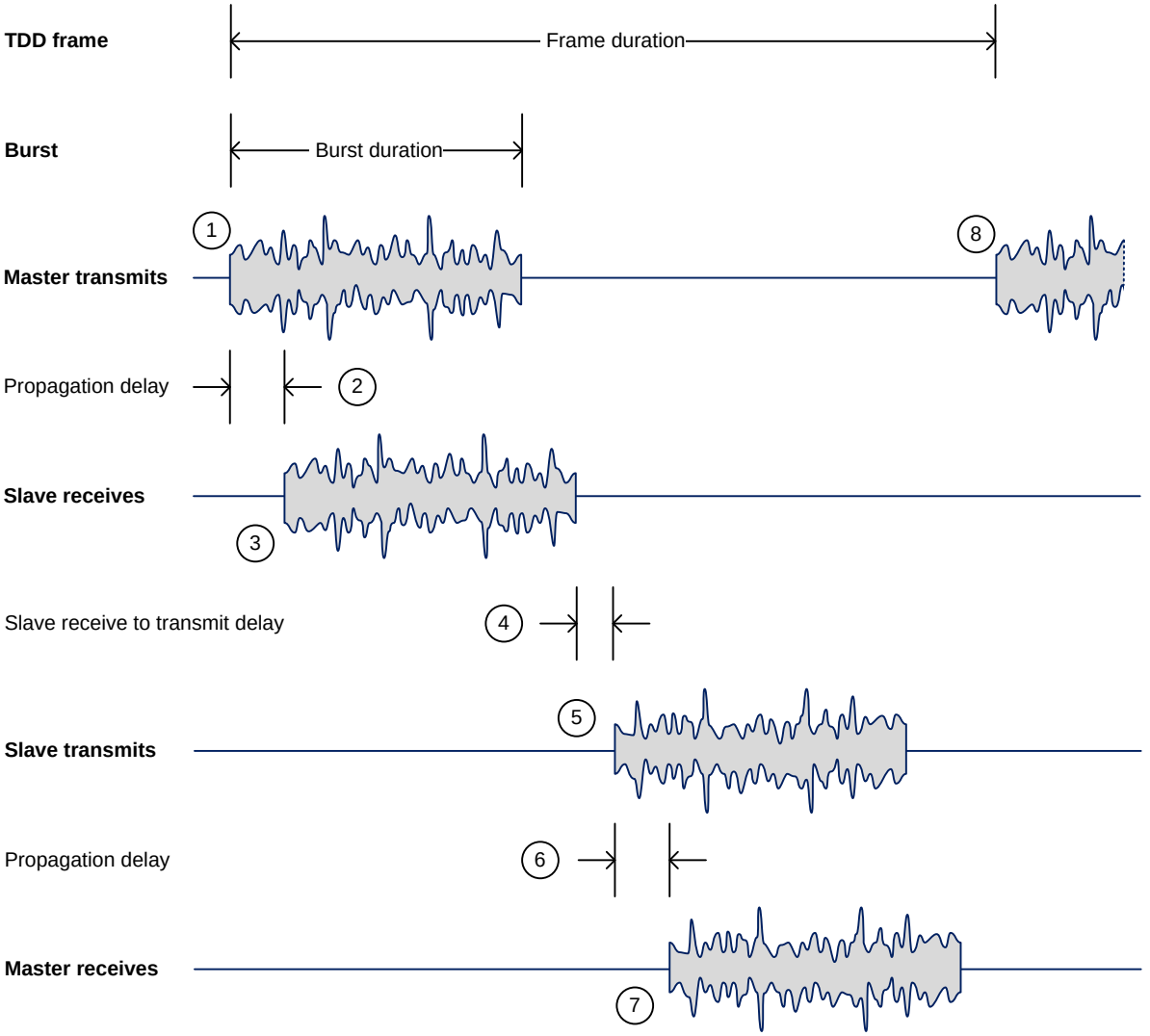
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Channel selection

The PTP 600 series links are capable of transmitting and receiving on the same channel or on different channels. In other words, the slave-master direction may use a different channel from the master-slave direction. Independent selection of transmit and receive frequencies can be useful in planned networks or for countering interference.

When links operate in radar avoidance regions, each unit must monitor its transmit channel for the presence of radar signals, and thus transmit and receive channels are always identical.

Figure 1-19 TDD cycle



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Link mode optimization

Link mode optimization allows the PTP 600 link to be optimized according to the type of traffic that will be bridged. The link supports two modes, IP Traffic and TDM Traffic.

IP traffic

IP Traffic mode is optimized to provide the maximum possible link capacity. IP Traffic mode is an appropriate choice where applications in the bridged networks provide some measure of reliable transmission, and where very low latency is not critical. IP mode supports both fixed and adaptive link symmetry (see Link symmetry on page 1-25).

TDM traffic

TDM Traffic mode is optimized to provide the lowest possible latency. TDM Traffic mode additionally implements a more conservative approach to adaptive modulation, leading to lower error rates in fading channels at the expense of slightly lower link capacity. TDM Traffic mode is an appropriate choice for delay intolerant data without reliable transmission (for example voice over IP data). TDM mode is selected automatically when Telecom interfaces are enabled.

Link symmetry

The PTP 600 series provides four configuration options for apportioning the available capacity between the two link directions.

- **Symmetric:** The Master and Slave have equal capacity. The PTP 600 series achieves this by allocating an equal Burst Duration for the Master and the Slave.
- **2:1** The capacity in the direction Master to Slave is twice that of the direction Slave to Master. The PTP 600 series achieves this by setting the Burst Duration of the Master to twice that of the Slave. This mode is not available when TDD synchronization is enabled.
- **1:2** The capacity in the direction Slave to Master is twice that of the direction Master to Slave. The PTP 600 series achieves this by setting the Burst Duration of the Slave to twice that of the Master.

  NOTE

  This mode is not available when TDD synchronization is enabled.

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- **Adaptive:** The capacity allocated to a given link direction is dependant on the offered level of network traffic in both link directions. If the level of offered traffic in both directions is equally high or equally low, the PTP 600 will allocate equal capacity to both directions. If however the offered level of traffic is greater in one direction, it is allocated a greater proportion of the overall link capacity. The PTP 600 series achieves this by increasing (or decreasing) the duration of the Transmit Burst in a given link direction as the offered level of network traffic increases (or decreases) in this same direction. This is done independently for the two directions.

  NOTE

  This mode is not available in the following configurations :

  - When link mode optimization is set to TDM Traffic see Link mode optimization on page 1-25).
  - When TDD synchronization is enabled.
  - In regions where radar avoidance is operational (see Radar avoidance on page 1-30).

OFDM and channel bandwidth

The PTP 600 series transmits using Orthogonal Frequency Division Multiplexing (OFDM). This wideband signal consists of many equally spaced sub-carriers. Although each sub carrier is modulated at a low rate using conventional modulation schemes, the resultant data rate from all the sub-carriers is high. OFDM works exceptionally over a Non-Line-of-Sight (NLoS) channel.

The channel bandwidth of the OFDM signal is configurable to one of five values: 5 MHz, 10 MHz, 15 MHz, 20 MHz and 30 MHz. Higher bandwidths provide greater link capacity at the expense of using more spectrum. Systems configured for a narrower channel bandwidth provide better receiver sensitivity and can also be an appropriate choice in deployments where the amount of free spectrum is limited.

Each channel is offset in center frequency from its neighboring channel by 10 MHz or 6 MHz.

NOTE

The Channel Bandwidth must be configured to the same value at both ends of the link.

Not all channel bandwidths are available in all regions or all frequency variants.

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Spectrum management

The spectrum management feature of the PTP 600 Series monitors the available wireless spectrum and directs both ends of the wireless link to operate on a channel with a minimum level of co-channel and adjacent channel interference.

Spectrum management measurements

The PTP 600 Series performs two mean signal measurements per TDD cycle, per channel. This mean measurement represents the mean received signal power for the 40 microseconds measurement period.

The Spectrum Management algorithm collects measurements equally from all channels. This process is called the Channel Availability Check (hereafter referred to by the acronym CAC). The CAC uses a round-robin channel selection process to collect an equal amount of measurements from each channel. The CAC measurement process is not altered by the channel barring process. Measurements are still collected for all channels irrespective of the number of barred channels.

Measurement analysis

Spectrum Management uses statistical analysis to process the received peak and mean measurement. The statistical analysis is based on a fixed, one minute, measurement quantization period. Spectrum Management collects data for the specified quantization period and only at the end of the period is the statistical analysis performed. The analysis produces three key metrics for each channel:

- Peak of Means
- 99.9% Percentile of the Means
- Mean of Means

These metrics are defined in Interpreting the spectrum management plots on page 7-27.

Statistical summary

The display of statistical measurement on the spectrum management page always shows a statistical summary of all channel measurement. The statistical summary is controlled by the Statistics Window attribute. This attribute defaults to a value of twenty minutes, which means that the mean and percentile values displayed for each channel are calculated over the 20 minute period. All channel decisions are made using the values computed over the statistics window period.

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Spectrum management in fixed frequency mode

The transmit and receive frequencies can be fixed in a PTP 600 wireless link. Once fixed frequency mode is configured, the spectrum management software will not attempt to move the wireless link to a channel with lower co-channel and adjacent-channel interference. Therefore this mode of operation is only recommended for deployments where the installer has a good understanding of the prevailing interference environment (see Step 2: Wireless configuration on page 6-54). Care must also be taken to ensure that the frequency allocations at each end of the link are compatible.

Adaptive modulation

The PTP 600 series can transport data over the wireless link using a number of different modulation modes ranging from 256QAM 0.81 to BPSK 0.63. For a given channel bandwidth and TDD frame structure, each modulation mode transports data at a fixed rate. Also, the receiver requires a given signal to noise ratio in order to successfully demodulate a given modulation mode. Although the more complex modulations such as 256QAM 0.81 will transport data at a much higher rate than the less complex modulation modes, the receiver requires a much higher signal to noise ratio.

The PTP 600 series provides an adaptive modulation scheme where the receiver constantly monitors the quality of the received signal and notifies the far end of the link of the optimum modulation mode with which to transmit. In this way, optimum capacity is achieved at all times. This is one of a number of features which allows the PTP 600 to operate in challenging none line of sight radio channels.

Specifications of capacity for all channel bandwidths, modulation modes and configurations are provided in Data throughput capacity on page 4-117.

Specifications of receive level thresholds for each modulation mode (assuming no interference) are provided in the various system threshold tables in Chapter 4 Reference information.

NOTE

Link Planner should be used to estimate the performance of a given link. Link Planner includes an estimate of mean data rate, the data rate provided by each modulation and the percentage of time spent in each modulation mode.

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MIMO

Multiple-Input Multiple-Output (MIMO) techniques provide protection against fading and increase the probability that the receiver will decode a usable signal. When the effects of MIMO are combined with those of OFDM techniques and a high link budget, there is a high probability of a robust connection over a non-line-of-sight path.

The PTP 600 transmits two signals on the same radio frequency, one of which is vertically polarized and the other horizontally polarized. The PTP 600 also has the ability to adapt between two modes of operation:

- **Dual Payload**: When the radio channel conditions allow, the PTP 600 will transmit two different and parallel data streams, one on the vertical channel and one on the horizontal channel. This doubles the capacity of the PTP 600.
- **Single Payload**: As the radio channel becomes more challenging, the PTP 600 has the ability to detect this and switch to a mode which transmits the same data stream on both vertical and horizontal channels. This provides polar diversity and is another key feature which allows the PTP 600 to operate in challenging non-line of sight radio channels.

The two modes have been implemented by the introduction of two sets of modulation modes. The lower order modulations (BPSK 0.63 up to QPSK 0.87) are only available as single payload modes. Each of the higher order modulations (16QAM 0.63 to 256QAM 0.81) are available in single payload mode and dual payload mode. The switching between modes is automatically controlled by the adaptive modulation feature described in Adaptive modulation on page 1-28.

Intelligent dynamic frequency selection

The PTP 600 series uses an interference mitigation technique known as Intelligent Dynamic Frequency Selection (i-DFS). Both the PTP 600 Master and PTP 600 Slave continually monitor for interference on all channels and then select the best frequency of operation. This is a dynamic process where the PTP 600 can continually move channels in response to changes in interference. Two modes of operation are available, one where the two link directions are forced to select the same frequency. This is determined by the Master. The second mode is where the frequency of operation can be determined independently for each direction. This is a key feature which enables the PTP 600 to operate successfully in areas where other radio equipments are operating within the same band. i-DFS is not available in the 2.5 GHz band.

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Radar avoidance

Radar avoidance requires that equipment used in the region:

- Detects interference from other systems and avoids co-channel operation with these systems, notably radar systems.
- Provides a uniform loading of the spectrum across all devices, that is, fixed frequency operation is not allowed.

To address the primary aims, the spectrum management algorithm implements a radar detection function which looks for impulsive interference on the operating channel only. If impulsive interference is detected, spectrum management will mark the current operating channel as having detected radar (unavailable channel) and initiate a channel hop to an available channel. The previous operating channel will remain in the unavailable state for thirty minutes after the last impulsive interference pulse was detected. After the thirty minutes have expired the channel will be returned to the usable channel pool.

The equipment can only transmit on available channels, of which there are none at initial power up. The radar detection algorithm will always scan a usable channel for 60 seconds for radar interference before making the channel an available channel. This compulsory channel scan will mean that there is at least 60 seconds service outage every time radar is detected and that the installation time is extended by at least 60 seconds even if there is found to be no radar on the channel.

NOTE

On system installation or start-up, this extends the initial scan time of the Master unit by 60 seconds. To address the requirement to provide aggregate uniform loading of the spectrum across all devices, the channel selection algorithm will choose a channel at random from a list of useable channels. The channel selection algorithm is initiated at link initialization and when radar interference is detected.

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Security

The Motorola PTP 600 Series supports optional encryption for data transmitted over the wireless link. The encryption algorithm used is the Advanced Encryption Standard (AES) with 128-bit and 256-bit key size. AES is a symmetric encryption algorithm approved by U.S. Government organizations (and others) to protect sensitive information. The AES implementation in PTP 600 is approved to FIPS-197.

Encryption is enabled through the purchase of an upgrade. Refer to Remote software upgrade by TFTP on page 7-38.

Region codes

Some aspects of wireless operation are controlled, enforced or restricted according to a Region Code. PTP 600 Region Codes represent individual countries (for example Denmark) or regulatory regions (for example FCC or ETSI).

Region Codes affect the following aspects of wireless operation:

- Maximum transmit power
- Radar avoidance
- Transmit power reduction in edge channels
- Frequency range
- Channel plan

A Region Code is encoded in the PTP 600 license key. The Region Code can be changed by generating and entering a new license key. Refer to Remote software upgrade by TFTP on page 7-38.

NOTE

Some units are supplied with two alternative license keys for different Region Codes, one of which is factory configured.

CAUTION

Always operate PTP 600 links in accordance with local regulations.

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PTP networks

Using Intelligent Dynamic Frequency Selection

The Intelligent Dynamic Frequency Selection (i-DFS) feature allows a PTP 600 unit to select wireless channels for a lower level of radio frequency (RF) interference. This approach is appropriate where the network consists of a small number of PTP links, or where the RF interference is predominantly from equipment belonging to other operators.

Using frequency planning

Networks will benefit from the use of fixed channel allocations if (a) the network consists of multiple PTP links, and (b) RF interference predominantly arises from equipment in the same network.

Frequency planning is the exercise of assigning operating channels to PTP units so as to minimize RF interference between links. Frequency planning must consider interference from any PTP unit to any other PTP unit in the network. Low levels of interference normally allow for stable operation and high link capacity.

The frequency planning task is made more straightforward by use of the following techniques:

- Using several different channels
- Separating units located on the same mast
- Using high performance (directional) external antennas

For help with planning networks, refer to Chapter 2 Planning considerations, or contact your Motorola distributor or re-seller.

Synchronized networks

TDD synchronization can be used to relax constraints on the frequency planning of PTP networks. Synchronization has the following benefits:

- Allows tighter frequency re-use, and thus wider channel bandwidth.
- Allows more convenient collocation of units on a single mast.
- Allows use of smaller or lower performance antennas.
- Reduces inference, resulting in use of more efficient modulation modes.

In a correctly designed synchronised network, all links are configured with the same TDD frame duration, and the TDD frame contains guard periods longer than the propagation delay between the most distant interfering units.

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Each synchronized unit is assigned to one of two phases. A master ODU can be assigned to either phase. A slave ODU must be assigned to a different phase from the associated master ODU.

TDD synchronization eliminates RF interference between units in the same phase. This means that frequency planning in a synchronized network is concerned only with interference between units in different phases. Frequency planning is still necessary, but the number of potential interference paths to be considered is halved. Frequency planning in a synchronized TDD network has approximately the same level of complexity as frequency planning in a Frequency Division Duplex (FDD) network.

TDD synchronization

Additional hardware

Additional hardware is needed to synchronize PTP 600 links. Two alternative approaches are supported:

- **MemoryLink UltraSync GPS receiver:** This unit contains a GPS receiver producing a 1 Hz timing reference locked to the GPS network. The UltraSync unit is connected directly to the Sync input at the master ODU. One UltraSync unit is required for each synchronized link.
- **PTP-SYNC**: This option is the preferred solution. One PTP-SYNC unit is required for each master ODU. The PTP-SYNC unit is connected in line in the drop cable between the PIDU Plus and the ODU, and is collocated with the PIDU Plus. The PTP-SYNC requires an external 1 Hz timing reference.

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Timing references for use with PTP-SYNC

PTP-SYNC requires an external timing reference in all but the simplest networks. Up to ten PTP-SYNCs can be connected in a chain to share the timing signal from one timing reference. In the majority of applications, one reference is required for each site that contains PTP 600 master ODUs.

The timing reference can be from any timing system that provides a 1 Hz signal, accurately synchronized in frequency and phase with a network-wide master timing reference. GPS timing receivers are a very practical way of obtaining a suitable reference. The PTP-SYNC is compatible with the following GPS timing receivers:

- Trimble Acutime™ Gold GPS receiver

In simple networks where all master ODUs are at a single site, the external reference can be omitted. In this case, one PTP 600 unit acts as a reference for other collocated units.

Configuring the TDD frame

In synchronized operation, frame duration and burst duration must be configured directly in the web-based management interface. Frame duration must be identical across all links in a synchronized network.

The PTP Link Planner provides a capability for computing suitable frame parameters in a synchronized network. Please refer to the *Link Planner User Guide* for guidance on configuring TDD synchronization.

Link symmetry is always 1:1 in synchronized networks.

Link capacity in synchronized networks

The TDD frame duration is extended in synchronized networks to allow for the propagation delay of the longest link in the network and to incorporate additional guard periods. These guard periods protect against delayed interference from distant units in the same network.

The longer frame duration results in slightly lower link capacity than for an equivalent non-synchronized link with the same channel bandwidth and modulation mode. However, TDD synchronization also reduces interference, and this may allow operation in higher modulation modes. The benefit of operating in a higher modulation mode normally outweighs the penalty of the slightly longer TDD frame.

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Advantages of PTP-SYNC over UltraSync

PTP-SYNC has several advantages over the UltraSync solution:

- PTP-SYNC does not require individual GPS receivers, nor must they be located close to the ODUs. This reduces the complexity and the cost of the installation on the mast.
- The GPS receiver can be located anywhere with a clear view of the sky, offering additional flexibility in the installation.
- The PTP-SYNC solution is compatible with standard 1 Hz interfaces, allowing an operator to take advantage of alternative timing references that may be already present at the site.
- The recommended GPS receiver continues to provide accurate timing even after the number of received satellites has dropped down to one, leading to significantly better availability of the reference signal.
- The PTP-SYNC offers the possibility of creating synchronized single-hub networks where no GPS receiver is required.

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Ethernet bridging

Customer network

Transparent Ethernet service

The PTP 600 Series provides an Ethernet service between the Ethernet port at a local ODU and the Ethernet port at an associated remote ODU. The Ethernet service is based on conventional layer two transparent bridging, and is equivalent to the Ethernet Private Line (EPL) service defined by the Metro Ethernet Forum (MEF).

The service is transparent to untagged frames, standard VLAN frames, priority-tagged frames, provider bridged frames, and provider backbone bridged frames. In each case, the service preserves MAC addresses, VLAN ID, Ethernet priority and Ethernet payload in the forwarded frame. The maximum frame size for bridged frames in the customer network is 2000 octets.

Layer two control protocols

The PTP 600 Series is transparent to layer two control protocols (L2CP) including:

- Spanning tree protocol (STP), rapid spanning tree protocol (RSTP)
- Multiple spanning tree protocol (MSTP)
- Link aggregation control protocol (LACP)
- Link OAM, IEEE 802.3ah
- Port authentication, IEEE 802.1X
- Ethernet local management interface (E-LMI), ITU-T Q.933.
- Link layer discovery protocol (LLDP)
- Multiple registration protocol (MRP)
- Generic attribute registration protocol (GARP)

The PTP 600 Series does not generate or respond to any L2CP traffic.

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Quality of service for bridged Ethernet traffic

The PTP 600 Series supports eight traffic classes for Ethernet frames queued for transmission over the wireless link. Ethernet frames are classified by inspection of the Ethernet priority code point in the outermost VLAN tag.

PTP 600 provides a configurable mapping between Ethernet priority and traffic class, together with a simple way to restore a default mapping based on the recommended default in IEEE 802.1Q-2005. Untagged frames can be classified into any one of the eight classes.

Scheduling for transmission over the wireless link is by strict priority. In other words, a frame at the head of a given queue is transmitted only when all higher priority queues are empty.

Fragmentation

The PTP 600 Series minimizes latency and jitter for high-priority Ethernet traffic by fragmenting Ethernet frames before transmission over the wireless link. The fragment size is selected automatically according to channel bandwidth and modulation mode of the wireless link. Fragments are reassembled on reception, and incomplete Ethernet frames are discarded.

Management network

IP interface

The PTP 600 ODU contains an embedded management agent with a single IP interface. Network management communication is exclusively based on IP and associated higher layer transport and application protocols. The default IP address

of the management agent is 169.254.1.1 in the master ODU and 169.254.1.2 in the slave ODU. The PTP 600 does not require use of supplementary serial interfaces.

MAC address

The management agent end-station MAC address is recorded on the enclosure. The MAC address is not configurable by the user.

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VLAN membership

The management agent can be configured to transmit and receive either untagged, priority-tagged, C-tagged (IEEE 802.1Q) or S-tagged (IEEE 801.ad) frames. S-tagged frames must be single tagged, in other words, an S-tag with no encapsulated C-tag. The VLAN ID can be 0 (priority tagged) or in the range 1 to 4094.

In-band management

In the in-band management mode, the management agent can be reached from the Ethernet port at the local ODU, and (assuming that the wireless link is established) the Ethernet port at the remote ODU.

Management frames in the customer network are processed by the management agent if (a) destination MAC address in the frame matches the ODU MAC address, and (b) the VLAN ID in the frame matches the VLAN configuration of the management agent.

If Local Packet Filtering is enabled, unicast frames forwarded to the management agent are filtered, that is, not forwarded in the customer network.

In-band quality of service

Frames generated within the management agent may be assigned a configured Ethernet priority. Management frames are multiplexed with customer frames of the same priority for transmission at the wireless port.

In-band local management

In the in-band local management mode, the management agent can be reached from the Ethernet port at the local ODU, but not from the Ethernet port at the remote ODU.

Management frames in the customer network are processed by the management agent if (a) destination MAC address in the frame matches the ODU MAC address, and (b) the VLAN ID in the frame matches the VLAN configuration of the management agent. All Ethernet frames in the management VLAN (regardless of destination address) are filtered (discarded) at the wireless port.

In-band local management mode is useful in networks that require only local access for network management. For correct operation of in-band local management mode, ensure that the same management VLAN ID is configured at both ends of the link.

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Source address learning

If Local Packet Filtering is enabled, the PTP 600 learns the location of end stations from the source addresses in received management frames. The agent filters transmitted management frames to ensure that the frame is transmitted at the Ethernet port, or over the wireless link as appropriate. If the end station address is unknown, then management traffic is transmitted at the Ethernet port and over the wireless link.

Wireless link down alert

The PTP 600 Series provides an optional indication of failure of the wireless link by means of a brief disconnection of the Copper data port or the Fiber data port. The Wireless link down alert can be used to trigger protection switching by Spanning Tree Protocol (STP) or Ethernet Automatic Protection Switching (EAPS) in a redundant network.

Back-to-back links

PTP 600 will not operate correctly if a direct cabled connection is made between two PIDUs. Where two or more links are deployed in a chain, always use an Ethernet switch or router to interconnect the links at the relay points.

Protocol model

Ethernet bridging behavior at each end of the wireless link is equivalent to a two-port, managed, transparent MAC bridge where the two ports are:

- Ethernet Port
- Wireless Port

Frames are transmitted at the Wireless port over a proprietary point-to-point circuit-mode link layer between ends of the PTP 600 link. Ethernet frames received at the Ethernet port, or generated internally within the management agent, are encapsulated within a lightweight MAC layer for transmission over the wireless link.

Protocol layers involved in bridging between Ethernet and wireless interfaces are shown in Figure 1-20. Protocol layers involved in bridging between external interfaces and the management agent are shown in Figure 1-21. In these figures, the layers have the meanings defined in IEEE 802.1Q-2005.

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Figure 1-20 Protocol layers between Ethernet and wireless interfaces

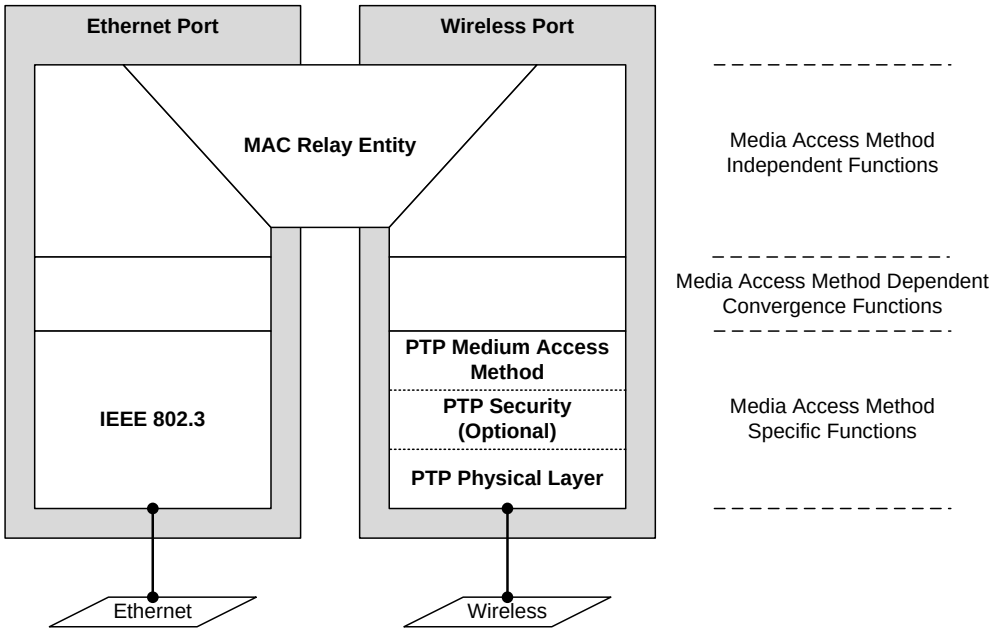
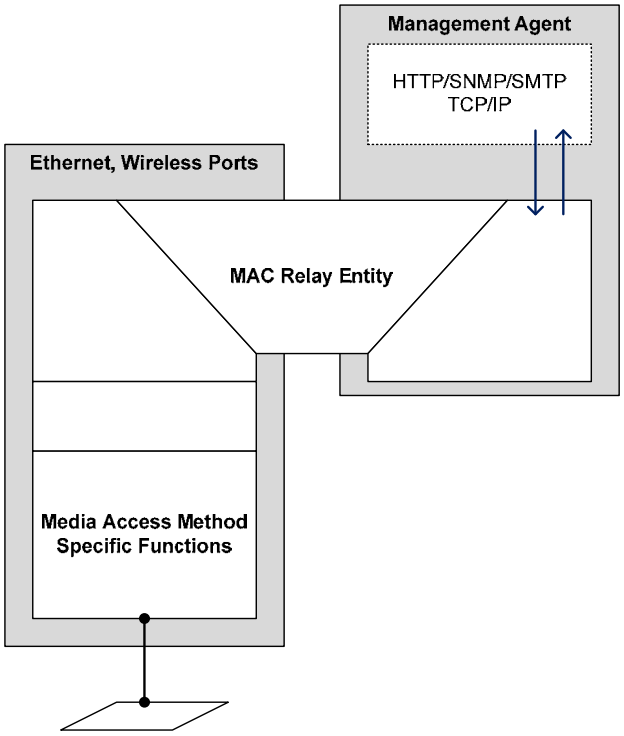


Figure 1-21 Protocol layers between external interfaces and the management agent



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Telecoms circuits

The PTP 600 link provides native support for one or two E1 links, or one or two T1 links. The link relays unstructured E1 or T1 data and provides accurate timing transfer.

Lowest telecoms modulation mode

In narrow channel bandwidth and lower modulation modes, the link may have insufficient capacity to relay the E1/T1 payload; in this case, the wireless link continues to carries timing information in order to maintain accurate clock synchronization. The relay of telecoms data resumes automatically when the link reaches a suitable modulation mode.

Links that are able to operate consistently in a high modulation mode can take advantage of lower link latency. This option is configured by setting the "Lowest Telecoms Modulation Mode" during installation. Appropriate settings for this control may be determined by using the Link Planner tool. The reduction in latency is achieved by disabling the relay of telecoms data in lower modulation modes, and this necessarily results in somewhat lower availability for the telecoms circuit. The loss of availability can be estimated using the Link Planner.

The unit will override the user setting of Lowest Telecoms Modulation Mode if the selected mode has insufficient capacity to carry the telecoms data, or if the mode demands very high latency and requires more buffering than the link can provide. When the effective mode differs for Single and Dual Payload operation two modes will be displayed: "Lowest Dual Payload Modulation Mode" and "Lowest Single Payload Modulation Mode".

Fixed frequency operation

In the PTP 600 link, data errors may occur during channel changes on an operational link. It may be appropriate to minimize channel-change-related errors in a link carrying Telecoms traffic by preventing channel changes initiated by i-DFS. This can be achieved by barring all channels except one in the Spectrum Management page, or alternately by selecting Fixed Frequency mode. These steps unavoidably disable interference avoidance mechanisms, and should not be taken if the risk of errors due to interference is more severe than the risk due to channel changes.

Fixed frequency operation is not available when radar detection requirements exist in the frequency band.

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Further reading

Installation details are provided in Installing an E1 or T1 interface on page 5-49.

E1/T1 circuits are configured using the web pages described in Updating wireless configuration on page 6-50 and Configuring telecoms circuits on page 6-68.

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System management

Management agent

PTP 600 equipment is managed through an embedded management agent. Management workstations, network management systems or PCs can be connected to this agent using standard management protocols multiplexed with user traffic at the Ethernet data port.

The management agent supports the following interfaces:

- Hyper text transfer protocol (HTTP)
- HTTP over transport layer security (HTTPS/TLS)
- RADIUS authentication
- TELNET
- Simple network management protocol (SNMP)
- Simple mail transfer protocol (SMTP)
- Simple network time protocol (SNTP)
- System logging (syslog)

Web server

The PTP 600 management agent contains a web server. The web server supports the HTTP and HTTPS/TLS interfaces.

Operation of HTTPS/TLS is enabled by purchase of an optional AES upgrade as described in Task 2: Install license keys on page 6-12.

Web-based management offers a convenient way to manage the PTP 600 equipment from a locally connected computer or from a network management workstation connected through a management network, without requiring any special management software. The web-based interfaces are the only interfaces supported for installation of PTP 600, and for the majority of PTP 600 configuration management tasks.

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The web-based management interfaces provide comprehensive web-based fault, configuration, performance and security management functions organized into the following web-pages and groups:

- **Home:** The Home web-page reports Wireless Link Status and basic information needed to identify the link. The Home page additionally lists all active alarm conditions
- **Status:** The Status web-page reports the detailed status of the PTP 600.
- **System:** These web-pages are used for configuration management, including IP and Ethernet, AES encryption keys, quality of service, software upgrade and installation of license keys. The System pages additionally provide detailed counters and diagnostic measurements used for performance management.
- **Installation:** The Installation Wizard is used in the initial configuration of the PTP 600 and arming the unit ready for alignment.
- **Management:** These web-pages are used to configure the network management interfaces.
- **Security:** The Security Wizard is used to configure the HTTPS/TLS interface, and to operate the PTP 600 unit in FIPS 140-2 operational mode. The Security Wizard is disabled until AES encryption is enabled by license key.
- **Change Password**: The Change Password web-page changes the web-interface password of the active user. Users use this screen to change their own password.
- **Logout:** Allows a user to log out from the web-based interface.

Transport layer security

The HTTPS/TLS interface provides the same set of web-pages as the HTTP interface, but allows HTTP traffic to be encrypted using Transport Layer Security (TLS). PTP 600 uses AES encryption for HTTPS/TLS. Operation of HTTPS/TLS is enabled by purchase of an optional AES upgrade as described in Task 2: Install license keys on page 6-12.

HTTPS/TLS requires installation of a private key and a public key certificate where the common name of the subject in the public key certificate is the IP address or host name of the PTP 600 unit.

HTTPS/TLS operation is configured through the web-based interfaces using the Security Wizard.

Details of the security material needed for HTTPS/TLS are provided in Security planning on page 2-37.

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NOTE

The PTP 600 has no default public key certificate, and Motorola is not able to generate private keys or public key certificates for specific network applications.

User account management

PTP 600 allows a network operator to configure a policy for login attempts, the period of validity of passwords and the action taken on expiry of passwords. See Configuring user accounts on page 6-36 for further details.

Identity-based user accounts

The PTP 600 web-based interface provides two methods of authenticating users:

- Role-based user authentication allows the user, on entry of a valid password, to access all configuration capabilities and controls. This is the default method.
- Identify-based user authentication supports up to 10 users with individual usernames and passwords.

When identity-based user accounts are enabled, a security officer can define from one to ten user accounts, each of which may have one of the three possible roles:

- Security officer.
- System administrator.
- Read only.

Identity-based user accounts are enabled in the Local User Accounts page of the web-based interface.

Password complexity

PTP 600 allows a network operator to enforce a configurable policy for password complexity. Password complexity configuration additionally allows a pre-determined best practice configuration to be set. See Configuring user accounts on page 6-36 for further details.

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RADIUS authentication

PTP 600 supports remote authentication for users of the web interface using the Challenge-Handshake Authentication Protocol (CHAP) over the Remote Authentication Dial In User Service (RADIUS). PTP 600 supports connections to primary and secondary RADIUS servers. The RADIUS interface is configured through the RADIUS Authentication page of the web-based interfaces.

PTP 600 RADIUS supports the standard Service Type attribute to indicate authentication roles of System Administrator and Read Only together with a vendor specific attribute to indicate authentication roles of Security Officer, System Administrator, and Read Only.

Remote authentication can be used in addition to local authentication, or can be used as a replacement for local authentication. If remote and local authentication are used together, PTP 600 checks log in attempts against locally stored user credentials before submitting a challenge and response for remote authentication. Remote authentication is not attempted if the username and password match locally stored credentials.

RADIUS is only available when PTP 600 is configured for Identity-based User Accounts. For more information, refer to RADIUS protocols and attributes on page 4-79.

SNMP

The management agent supports fault and performance management by means of an SNMP interface. The management agent is compatible with SNMP v1, SNMP v2c, and SNMPv3 using the following Management Information Bases (MIBs):

- RFC-1493. BRIDGE-MIB. dot1dBase group.
- RFC-2233. IF-MIB. Interfaces group, and ifXTable table.
- RFC-3411. SNMP-FRAMEWORK-MIB. snmpEngine group.
- RFC-3412. SNMP-MPD-MIB. snmpMPDStats group.
- RFC-3413. SNMP-TARGET-MIB. snmpTargetObjects group and SNMP-NOTIFICATION-MIB snmpNotifyTable table.
- RFC-3414. SNMP-USER-BASED-SM-MIB. usmStats group and usmUser group.
- RFC-3415. SNMP-VIEW-BASED-ACM-MIB vacmMIBObjects group.
- RFC-3418. SNMPv2-MIB. System group, SNMP group, and set group.
- RFC-3826. SNMP-USM-AES-MIB. usmAesCfb128Protocol OID.
- PTP 600 Series proprietary MIB

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SNMPv3 security

SNMP Engine ID

PTP 600 supports three different formats for SNMP Engine ID:

- MAC address
- IP address
- Configurable text string

SNMPv3 security configuration is re-initialized when the SNMP Engine ID is changed.

User-based security model

PTP 600 supports the SNMPv3 user-based security model (USM) for up to 10 users, with MD5, SHA-1, DES and (subject to the license key) AES protocols in the following combinations:

- No authentication, no privacy,
- MD5, no privacy,
- SHA-1, no privacy,
- MD5, DES,
- SHA-1, DES,
- MD5, AES,
- SHA-1, AES.

Use of AES privacy requires the PTP 600 AES upgrade described in AES license on page 1-52. The ODU will allow the creation of users configured with AES privacy protocol, regardless of license key. However, a user configured to use AES privacy protocol will not be able to transmit and receive encrypted messages unless the license key enables the AES capability.

View-based access control model

PTP 600 supports the SNMPv3 view-based access control model (VACM) with a single context. The context name is the empty string. The context table is read-only, and cannot be modified by users.

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Access to critical security parameters

The SNMPv3 management interface does not provide access to critical security parameters (CSPs) of PTP 600. It is not possible to read or modify AES keys used to encrypt data transmitted at the wireless interface. Neither is it possible to read or modify security parameters associated with TLS protection of the web-based management interface. The recovery mode option to zeroize CSPs does not affect SNMPv3 configuration.

MIB-based management of SNMPv3 security

PTP 600 supports a standards-based approach to configuring SNMPv3 users and views through the SNMP MIB. This approach provides maximum flexibility in terms of defining views and security levels appropriate for different types of user.

PTP 600 provides a default SNMPv3 configuration. This initial configuration is not secure, but it provides the means by which a secure configuration can be created using SNMPv3.

The secure configuration should be configured in a controlled environment to prevent disclosure of the initial security keys necessarily sent as plaintext, or sent as encrypted data using a predictable key. The initial security information should not be configured over an insecure network.

The default configuration is restored when any of the following occurs:

- All ODU configuration data is erased.
- All SNMP users are deleted using the SNMP management interface.
- The SNMP Engine ID Format has been changed.
- The SNMP Engine ID Format is IP Address AND the IP Address has been changed.
- The SNMP Engine ID Format is Text String AND the text string has been changed.
- The SNMP Engine ID Format is MAC Address AND configuration has been restored using a file saved from a different unit.
- SNMPv3 Security Management is changed from web-based to MIB-based.

The default user configuration is specified in SNMPv3 default configuration (MIB-based) on page 4-77.

PTP 600 creates the `initial` user and template users with localized authentication and privacy keys derived from the passphrase string `123456789`. Authentication keys for the templates users are fixed and cannot be changed. Any or all of the template users can be deleted.

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The default user `initial` is created with a view of the entire MIB, requiring authentication for SET operations. There is no access for template users.

NOTE

VACM grants access for requests sent with more than the configured security level.

The default user `initial` will have read/write access to the whole of the MIB. This is described in further detail in View-based access control model on page 1-47. The template users have no access to the MIB in the default configuration. User `initial` will normally be used to create one or more additional users with secret authentication and privacy keys, and with appropriate access to the whole of the MIB or to particular views of the MIB according to the operator's security policy. New users must be created by cloning template users. The user `initial` may then be deleted to prevent access using the well-known user name and keys. Alternatively, the keys associated with `initial` may be set to some new secret value.

Web-based management of SNMPv3 security

PTP 600 supports an alternative, web-based approach for configuring SNMPv3 security. In this case, the web-based interface allows users to specify SNMPv3 users, security levels, privacy and authentication protocols, and passphrases. Web-based management will be effective for many network applications, but the capabilities supported are somewhat less flexible than those supported using the MIB-based security management.

Selection of web-based management for SNMPv3 security disables the MIB-based security management.

Web-based management of SNMPv3 security allows for two security roles:

- Read Only
- System Administrator

Read Only and System Administrator users are associated with fixed views allowing access to the whole of the MIB, excluding the objects associated with SNMPv3 security. System Administrators have read/write access as defined in the standard and proprietary MIBs.

Web-based management of SNMPv3 security allows an operator to to define the security levels and protocols for each of the security roles; all users with the same role share a common selection of security level and protocols.

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Web-based security configuration is re-initialized when any of the following occurs:

- All ODU configuration data is erased.
- The SNMP Engine ID Format has been changed.
- The SNMP Engine ID Format is IP Address and the IP Address has been changed.
- The SNMP Engine ID Format is Text String and the text string has been changed.
- The SNMP Engine ID Format is MAC Address and configuration has been restored using a file saved from a different unit.
- SNMPv3 Security Management is changed from MIB-based to web-based.

Additionally, all SNMP user accounts are disabled when the authentication protocol, the privacy protocol, or the security level is changed.

Downgrade of the license key

A possible lockout condition exists if a user downgrades the PTP 600 license key so as to disable the AES capability when SNMPv3 users are configured with AES privacy and VACM is configured to require privacy. In this case, recovery is by either (a) restoring the correct license key, or (b) using recovery mode to erase all configuration and entering new configuration.

Option (b) will cause default users and access configuration to be re-created.

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System logging (syslog)

PTP 600 supports the standard syslog protocol to log important events. The protocol complies with RFC 3164.

PTP 600 reports syslog event notification messages in the following families:

- Local log
- Standard events
- SNMPv3
- Authentication
- Authentication configuration
- Telnet
- TFTP
- RADIUS
- Security configuration
- License key
- System
- Time
- Low resource

The individual event notification messages are listed in Event notification messages on page 4-82.

PTP 600 can be configured to send event notification messages to one or two standard syslog servers.

Additionally, PTP 600 can be configured to log event notification messages locally. Locally-stored event messages survive reboot of the unit, and are overwritten only when the storage capacity is exhausted (approximately 2000 messages). The locally stored events can be reviewed using the web-based user interface.

Only users with Security Officer role are permitted to configure the syslog client. Users with Security Officer or System Administrator roles are permitted to review the locally logged event messages.

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AES license

PTP 600 provides optional encryption using the Advanced Encryption Standard (AES). Encryption is not available in the standard PTP 600 system.

AES upgrades are supplied as an access key purchased from your Motorola Point-to-Point distributor or solutions provider. The access key authorizes AES operation for one ODU. Two access keys are needed to operate AES on a link. The upgrade is applied by entering an access key together with the MAC address of the target ODU into the PTP License Key Generator web page, which may be accessed from http://www.motorola.com/ptp/support.

The License Key Generator creates a new license key that is delivered by email. The license key must be installed on the ODU. When the license key is installed, the ODU must be rebooted before AES can be enabled. Once applied, the AES upgrade is bound to a single ODU and is not transferrable.

AES encryption may be used in the following ways:

- At the wireless port to encrypt data transmitted over the wireless link.
- At the SNMP management interface in the SNMPv3 mode.
- At the HTTPS/TLS management interface.

Two levels of encryption are available to purchase:

- 128-bit: This allows an operator to encrypt all traffic sent over the wireless link using 128-bit encryption.
- 256-bit: This allows an operator to encrypt traffic using either 128-bit or 256-bit encryption.

Encryption must be configured with the same size key in each direction.

AES encryption at the PTP 600 wireless port is based on pre-shared keys. An identical key must be entered at each end of the link.

AES encryption for SNMPv3 or TLS is always based on a 128-bit key, regardless of level enabled in the PTP 600 license key.

For more information, see:

- Task 2: Install license keys on page 6-12
- Task 4: Configure security on page 6-21

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Critical security parameters

Critical security parameters (CSPs) are as follows:

- Key of keys.
- AES encryption keys for the wireless interface.
- Private key for the HTTPS/TLS interface.
- Entropy value for the HTTPS/TLS interface.
- User account passwords for the web-based interface.

CSPs can be erased (zeroized) using the Zeroize CSPs page of the web-based interface or by selecting the Zeroize CSPs option in Recovery mode.

Capacity upgrades

Capacity upgrades are supplied as an access key purchased from your Motorola Point-to-Point distributor or solutions provider. The upgrade is applied by entering an access key together with the MAC address of the target ODU into the PTP License Key Generator web page, which may be accessed from http://www.motorola.com/ptp/support.

The License Key Generator creates a new license key delivered by email. The license key must be installed on the ODU as described in reference to Task 2: Install license keys on page 6-12. Once applied, the capacity upgrade is bound to a single ODU and is not transferrable.

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Software upgrade

The management agent supports application software upgrade using either the web-based interface or the SNMP interface.

PTP 600 software images are digitally signed, and the ODU will accept only images that contain a valid Motorola PTP digital signature. The ODU always requires a reboot to complete a software upgrade.

NOTE

Obtain the application software and this user guide from the support website BEFORE warranty expires.

NOTE

ODU software version must be the same at both ends of the link. Limited operation may sometimes be possible with dissimilar software versions, but such operation is not supported by Motorola.

The management process for software upgrade is described in detail in Task 3: Upgrade software version on page 6-16.

Software can be downgraded using Recovery mode as described in Recovery mode on page 1-54.

Recovery mode

The PTP 600 recovery mode provides a means to recover from serious configuration errors including lost or forgotten passwords and unknown IP addresses.

Recovery mode also allows new main application software to be loaded even when the integrity of the existing main application software image has been compromised. The most likely cause of an integrity problem with the installed main application software is where the power supply has been interrupted during an earlier software upgrade.

The ODU operates in recovery mode in the following circumstances:

- When a checksum error occurs for the main application software image.
- When the PIDU Plus recovery button is pressed at the same time as the ODU is rebooted or power cycled.

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Recovery mode options

Options in recovery mode are as follows:

- Load new main application software.
- Reset all configuration data to factory default. This option resets IP and Ethernet configuration, and erases (zeroizes) critical security parameters.
- Reset IP and Ethernet configuration to factory default.
- Erase (zeroize) critical security parameters.
- Reboot with existing software and configuration.

NOTE

If recovery mode has been entered because of a checksum error, by default the ODU will reboot with existing software and configuration, following a 30 second wait.

The recovery software image is installed during manufacture of the ODU and cannot be upgraded by operators.

For detailed instructions on using the recovery mode, see Using recovery mode on page 8-21.

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FIPS 140-2

PTP 600 provides an optional secure cryptographic mode of operation validated to Level 2 of Federal Information Processing Standards Publication 140-2.

FIPS 140-2 capability

A PTP 600 unit is capable of operating in the FIPS 140-2 mode when all of the following are true:

- The hardware security of the ODU is compatible with operation in the FIPS 140-2 mode.
- The ODU license key has AES encryption enabled.
- The ODU license key has FIPS operation enabled.
- The ODU software image is validated for FIPS operation.

Hardware security

The ODU has compatible hardware security if the part number suffix on the external packaging is no earlier than the minimum listed in Table 1-7.

Table 1-7 Minimum part number suffix for FIPS 140-2 mode

Frequency variant	Part number suffix
PTP 25600	BB
PTP 45600	BB
PTP 48600	AA
PTP 49600	AA
PTP 54600	EE
PTP 58600	DD
PTP 59600	BB

The ODU will also have compatible hardware security if the part number suffix is earlier and PTP 600 Hardware Security Upgrade has been applied. The Hardware Security Upgrade Kit is available as Motorola part number WB3593AA.

Units with compatible hardware security have tamper-evident labels fitted as shown in Figure 1-22 and Figure 1-23.

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Figure 1-22 Tamper evident label on side edge of ODU

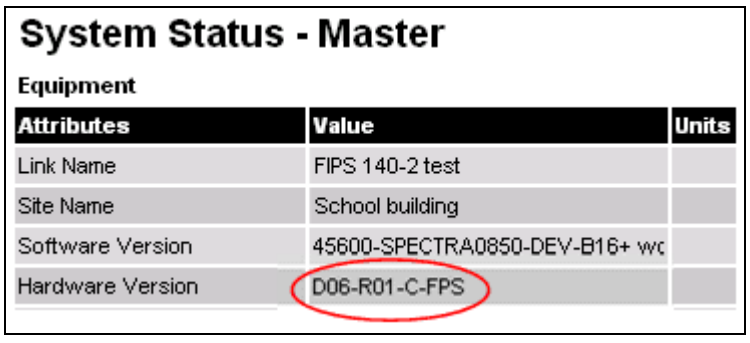


Figure 1-23 Tamper evident label on top edge of ODU



The ODU will have hardware security compatible with FIPS 140-2 if the hardware version displayed on the Status page contains the string ‘FPS’, as shown in Figure 1-24. This provides an alternative means of checking hardware where the ODU has already been deployed, and is in a physical location that makes it difficult to observe tamper-evident labels.

Figure 1-24 FIPS 140-2 hardware version identification



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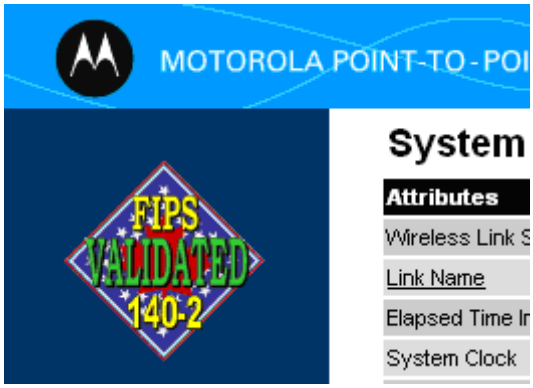
Validated software image

FIPS validated software images are indicated by a `FIPS-` prefix to the file name, for example: `FIPS-PTP600-09-01.DLD2`. The general features of a FIPS validated software image are identical to those of the standard image with the same version number. For example, `FIPS-PTP600-09-01.DLD2` is equivalent to `PTP600-09-01.DLD2` apart from the ability of the FIPS image to operate in FIPS mode.

Indication of FIPS 140-2 capability

The FIPS 140-2 capability is indicated by a distinctive symbol displayed at the top of the navigation bar in the web-based interface, as shown in Figure 1-25.

Figure 1-25 Indication of FIPS 140-2 capability



FIPS 140-2 mode

PTP 600 operates in the FIPS 140-2 mode when all of the following are true:

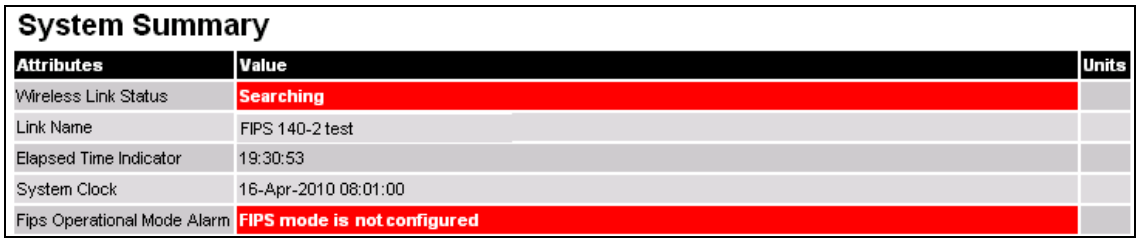
- The PTP 600 is FIPS 140-2 capable.
- The HTTPS/TLS management interface is enabled.
- The HTTP management interface is disabled.
- The Telnet management interface is disabled.
- SNMP control of HTTP and Telnet is disabled.
- AES encryption is enabled at the wireless interface.
- The HTTPS/TLS management interface is configured for identity-based user accounts.
- RADIUS authentication of web-based users is disabled.

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FIPS operational mode alarm

The FIPS operational mode alarm indicates that the unit is FIPS 140-2 capable, but has not been configured correctly for FIPS 140-2 operation. The FIPS operational mode alarm appears as shown in Figure 1-26.

Figure 1-26 FIPS operational mode alarm



Indication of FIPS 140-2 mode

The PTP 600 is operating in FIPS 140-2 mode when the FIPS 140-2 capability logo is displayed in the navigation bar and the FIPS Operation Mode Alarm is absent from the Home page.

Exiting from the FIPS 140-2 operational mode

A PTP 600 ODU in FIPS 140-2 operational mode can be prepared to accept new security configuration by zeroizing critical security parameters (CSPs). The unit remains FIPS 140-2 capable.

Reverting to standard operation

A FIPS 140-2 capable ODU can be used in standard (non-FIPS) mode by loading a standard (non-FIPS) software image and rebooting.

The critical security parameters (CSPs) are zeroized when the unit is no longer FIPS 140-2 Capable.

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Chapter 2 Planning considerations

This chapter provides information to help the user to plan a PTP 600 link.

The following topics are described in this chapter:

- Spectrum planning on page 2-2
- Site planning on page 2-6
- Link planning on page 2-10
- Grounding and lightning protection on page 2-14
- Configuration options for TDD synchronization on page 2-27
- Mounting options for the PTP-SYNC GPS receiver on page 2-32
- Data network planning on page 2-35
- Security planning on page 2-37

To calculate the data throughput capacity of a planned PTP 600 link, see Data rate calculations on page 4-114.

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Spectrum planning

Each frequency variant has specific licensing restrictions that affect frequency range, radar avoidance and channel bandwidth usage.

Selecting a license for the region code

Ensure the link is configured to conform to local regulatory requirements by installing License Keys for the correct region code.

⚠ CAUTION

For the connectorized model, when using external antennas of higher gain than the appropriate integrated antenna, the regulations may require the maximum Tx power to be reduced. To ensure that regulatory requirements are met for connectorized installations, refer to Regulatory issues with connectorized units on page 4-94.

The license and region codes for each frequency variant are listed in Licenses and region codes on page 4-36.

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Frequency selection

Choose a method of frequency selection. The choice depends upon whether or not the region mandates radar detection.

Regions without mandatory radar detection

In regions that do not mandate DFS (Radar Detection), the frequencies may be configured symmetrically or asymmetrically (different transmit and receive frequencies). Select a Spectrum Management Control option from the following list:

- **Intelligent Dynamic Frequency Selection (i-DFS)**: This method continually monitors the spectrum looking for the channel with the lowest level of on channel and co-channel interference. Statistical techniques are used to select the most appropriate transmit and receive channels. The i-DFS mode can be influenced in its channel decision process by selectively barring channels from use.
- **Fixed Frequency**: This method allows the installer to allocate fixed transmit and receive frequencies on the units.

Regions with mandatory radar detection

In regions that mandate DFS (Radar Detection), the frequency must always be symmetrical (transmit and receive on the same frequency). Select a Spectrum Management Control option from the following list:

- **Dynamic Frequency Selection (DFS)**: This method detects interference from other systems and avoids co-channel operation with these systems, notably radar systems.
- **DFS with i-DFS**: This method is similar to i-DFS. It differs in the event that several alternative channels are equally the best within the 1 dB measurement resolution. In **i-DFS**, the ODU selects the lowest channel number out of the set of best channels. In **DFS with i-DFS,** the ODU monitors the interference level on all the available channels and then randomly selects one channel from all that are within 3dB of the lowest interference channel.

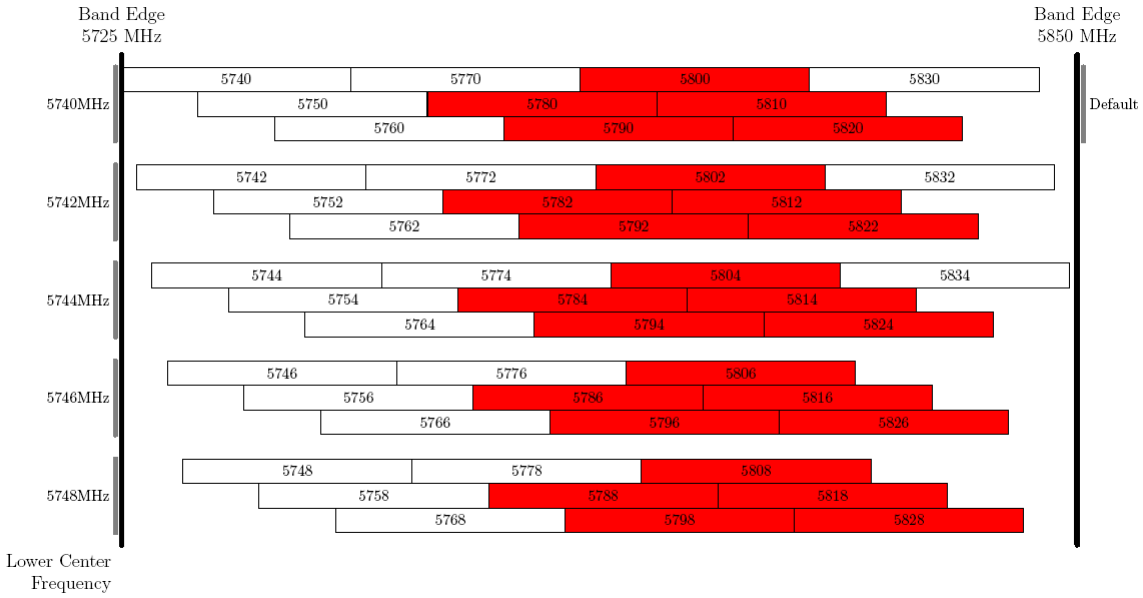
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Radar avoidance

Ensure that the link can operate without using any barred channels. Where regulatory restrictions apply to certain channels, these channels are barred. RTTT avoidance may be necessary in all channel bandwidths. The number of channels barred is dependant on the channel raster selected.

For example, the effect of the UK RTTT channel restrictions in the 30 MHz bandwidth is shown in Figure 2-1, where blocks in red indicate channels that are barred. Barred channels are indicated by a 'No Entry' symbol displayed on the Spectrum Management web page, see Spectrum management in radar avoidance mode on page 7-31.

Figure 2-1 RTTT channel avoidance example (5.8 GHz UK)



NOTE

Radar avoidance requirements in the 5.4GHz band in the EU is detailed in specification EN 301-893 version V1.5.1 plus additional requirements shown in the OJ of the EC and in the US in the specification FCC part 15.407. Radar avoidance at 5.8 GHz is applicable to EU operation and the requirements are currently as defined in EN 302 502.

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Variable channel bandwidth operation

Select the Channel Bandwidth and Lower Center Frequency for the link.

The selection of Channel Bandwidth depends upon the PTP 600 frequency variant:

- For PTP 25600, PTP 45600, PTP 54600, PTP 58600 and PTP 59600, Channel Bandwidth may be 30, 15, 10 or 5 MHz.
- For PTP 48600 and PTP 49600, Channel Bandwidth may be 20, 10 or 5 MHz.

The 30MHz channel widths are available where allowed by local regulations and subject to some restrictions on channel choice.

Lite versions of the PTP 600 products do not support a Channel Bandwidths of 5 MHz.

Configuration of the variable bandwidth operation must be symmetric, that is, the Transmit and receive channels must use identical Channel Bandwidths.

For details of the spectrum settings that are available to each frequency variant, refer to Available spectrum settings on page 4-44.

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Site planning

ODU site selection

When selecting a site for the ODU, consider the following factors:

- It should not be possible for people to stand or walk in front of the antenna.
- Height and location to achieve the best radio path.
- Height in relation to other objects with regard to lightning strikes.
- Aesthetics and planning permission issues.
- Distance from the ODU to the connected Network equipment (Maximum cable run from the ODU to the connected equipment is 100 m [330 ft]).
- Distance from the PIDU Plus to the ODU (Maximum cable run from the PIDU Plus to the ODU is 300 m [990 ft] when using the Fiber interface).
- If using the UltraSync unit, ensure that it is exposed to an unobstructed path to the sky. Please refer to the user manual delivered with the kit.
- The effect of strong winds on the installation. See Section Wind loading on page 2-7.

PIDU Plus site selection

When selecting a site for the PIDU Plus, consider the following factors:

- Indoor location with no possibility of condensation.
- Availability of a mains electricity supply.
- Accessibility for viewing status indicators and pressing Recovery switch.

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PTP-SYNC site selection

If PTP-SYNC is to be installed, consider the following factors when selecting a site:

- Indoor location, or outdoor in a weatherproofed cabinet, with no possibility of condensation.
- Accessibility for viewing status indicators.
- Distance from the ODU to the PTP-SYNC unit (maximum cable run from the ODU to the PTP-SYNC unit is 40 m [131 ft]).
- Distance from the PIDU Plus to the PTP-SYNC unit (maximum cable run from the PIDU Plus to the PTP-SYNC unit is 2 m [6 ft]).
- Distance from the PIDU Plus to the connected network equipment (maximum cable run from the PIDU Plus to the connected equipment is 20 m [65 ft] when the PTP-SYNC is in use).

A rack mounting adaptor is available for the PTP-SYNC unit.

Wind loading

Ensure that the site will not be prone to excessive wind loading.

Antennas and equipment mounted on towers or buildings will subject the mounting structure to significant lateral forces when there is appreciable wind. Antennas are normally specified by the amount of force (in pounds) for specific wind strengths. The magnitude of the force depends on both the wind strength and size of the antenna.

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Calculation of lateral force

The PTP 600 Series, with or without the integral antenna, is essentially a flat structure and so the magnitude of the lateral force can be estimated from:

Force (in pounds) = $0.0042 . A . v^2$

Where A is the surface area in square feet and v is the wind speed in miles per hour.

The lateral force produced by a single PTP 600 ODU (integrated or connectorized model) at different wind speeds is shown in Table 2-1 and Table 2-2.

Table 2-1 Lateral force – metric

	Largest Surface Area (sq m)	Lateral Force (Kg) at wind speed (m/s)				
		30	40	50	60	70
Integrated PTP 600	0.130	12	22	34	49	66
Connectorized PTP 600	0.093	9	16	24	35	48

Table 2-2 Lateral force – US

	Largest Surface Area (sq ft)	Lateral Force (lb) at wind speed (mph)				
		80	100	120	140	150
Integrated PTP 600	1.36	36.6	57.1	82.3	146.2	228.5
Connectorized PTP 600	1.00	26.9	42	60.5	107.5	168.0

NOTE

When the connectorized ODU is used with external antennas, the figures from the antenna manufacturer for lateral force should be included to calculate to total loading on the mounting structure.

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Capabilities of the PTP 600 Series

The structure and mounting brackets of the PTP 600 Series are capable of withstanding wind speeds up to 242 kph (151 mph). Ensure that the structure to which the PTP 600 Series is fixed to is also capable of withstanding the prevalent wind speeds and loads.

Wind speed statistics

Contact the national meteorological office for the country concerned to identify the likely wind speeds prevalent at the proposed location. Use this data to estimate the total wind loading on the support structures. Sources of information:

- US National Weather Service, http://www.nws.noaa.gov/
- UK Meteorological Office, www.meto.gov.uk

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Link planning

Link planning must take account of range, obstructions and path loss.

Range and obstacles

Calculate the range of the link and identify any obstacles that may affect radio performance.

Performed a survey to identify all the obstructions (such as trees or buildings) in the path and to assess the risk of interference. This information is necessary in order to achieve an accurate link feasibility assessment.

The PTP 600 Series is designed to operate in Non-Line-of-Sight (NLoS) and Line-of-Sight (LoS) environments. An NLOS environment is one in which there is no optical line-of-sight, that is, there are obstructions between the antennas.

The PTP 600 Series will operate at ranges from 100 m (330 ft) to 200 km (124 miles), within 3 modes: 0-40km (0-25 miles), 0-100km (0-62 miles) and 0-200km (0-124 miles). Operation of the system will depend on obstacles in the path between the units. Operation at 40 km (25 miles) or above will require a near line-of-sight path. Operation at 100 m (330 ft) could be achieved with one unit totally obscured from the other unit, but with the penalty of transmitting at higher power in a non-optimal direction, thereby increasing interference in the band.

NOTE

In radar detection regions, the minimum operating range of the PTP 600 is 300 metres (990 ft).

PTP Link Planner

Link planning enables a link of known quality to be installed. This involves the acquisition of path profile data (using Motorola's free Link Planner utility). The Link Planner predicts data rates and reliability over the path. It allows the user to try different antenna heights and RF power settings. When the link is installed, the mean path loss can be checked to confirm that the predicted data rate and link reliability is achievable. Motorola Link Planner is available to download from http://www.motorola.com/ptp/support.

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Using PTP Link Planner for synchronized networks

TDD synchronization should be planned using Link Planner. This will provide the necessary TDD Frame parameter values which are required to complete a synchronized installation. Please refer to the *Link Planner User Guide*.

Path loss considerations

Path loss is the amount of attenuation the radio signal undergoes between the two ends of the link.

Calculating path loss

The path loss is the sum of the attenuation of the path if there were no obstacles in the way (Free Space Path Loss), the attenuation caused by obstacles (Excess Path Loss) and a margin to allow for possible fading of the radio signal (Fade Margin). The calculation of Equation 2-1 needs to be performed to judge whether a particular link can be installed.

Equation 2-1 Path loss

$$L_{free\_space} + L_{excess} + L_{fade} + L_{seasonal} < L_{capability}$$

Where

L_{free_space}	Free Space Path Loss (dB)
L_{excess}	Excess Path Loss (dB)
L_{fade}	Fade Margin Required (dB)
$L_{seasonal}$	Seasonal Fading (dB)
$L_{capability}$	Equipment Capability (dB)

Adaptive modulation

Adaptive modulation ensures that the highest throughput that can be achieved instantaneously will be obtained, taking account of propagation and interference. When the link has been installed, web pages provide information about the link loss currently measured by the equipment, both instantaneously and averaged. The averaged value will require maximum seasonal fading to be added, and then the radio reliability of the link can be computed.

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For minimum error rates on TDM links, the maximum modulation mode should be limited to 64QAM 0.75.

The values for (BPSK) are static receive sensitivity measurements. The other values are static receive sensitivity measurements with an AMOD threshold applied. The AMOD threshold applied is for a benign radio channel.

Modulation mode affects the following:

Sensitivity

Sensitivity is defined as the combined receive input signal level on both horizontal and vertical inputs that produces a Null BER Error ratio of 3x10-7.

Output Power

The output power is for a centre channel in Region 1. The output power will be reduced on the edge channels and may vary if different region codes are selected.

AMOD Threshold

The AMOD threshold is the combined receive input signal level on both horizontal and vertical inputs that results in the link consistently entering the receive modulation mode under consideration as the signal level is increased.

System Threshold

Thresholds for all modes except BPSK are for the relevant link optimization AMOD thresholds. System threshold for BPSK is the RPSK receive sensitivity.

Max Link Loss

The maximum link loss for each modulation mode is derived from the AMOD threshold for that mode (sensitivity threshold for BPSK) and the maximum Region 1 centre channel output power. The figures assume integral antennas are used, with gain depending upon frequency band as follows:

- 23 dBi (5.9 GHz, 5.8 GHz and 5.4 GHz)
- 22 dBi (4.8 GHz and 4.9 GHz)
- 21.5 dBi (4.5 GHz)
- 18 dBi (2.5 GHz)

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When to use the connectorized PTP 600 antennas

The majority of radio links can be successfully deployed with the PTP 600 Series. It should only be necessary to use external antennas where the Link Planner indicates marginal performance for a specific link, for example when the link is heavily obscured by dense woodland on an NLOS link or extremely long LOS links (>80km or >50 miles) over water.

The external antennas can be either dual-polarization (as the integrated antenna) or two single polarized antennas can be used in a spatially diverse configuration. It is expected that the dual-polarization antennas would normally be used to simplify the installation process; spatially diverse antennas may provide additional fade margin on very long LOS links where there is evidence of correlation of the fading characteristics on Vertical and Horizontal polarizations.

System threshold, output power and link loss

For details of the system threshold, output power and link loss for each frequency variant in all modulation modes for all available channel bandwidths, refer to System threshold, output power and link loss on page 4-62.

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Grounding and lightning protection

Structures, equipment and people must be protected against power surges (typically caused by lightning) by conducting the surge current to ground via a separate preferential solid path.

The actual degree of protection required depends on local conditions and applicable local regulations.

Motorola recommends that PTP 600 installation is contracted to a professional installer.

⚠ WARNING

Electro-magnetic discharge (lightning) damage is not covered under warranty. The recommendations in this guide, when followed correctly, give the user the best protection from the harmful effects of EMD. However 100% protection is neither implied nor possible.

Standards

Full details of lightning protection methods and requirements can be found in the international standards IEC 61024-1 and IEC 61312-1, the U.S. National Electric Code ANSI/NFPA No. 70-1984 or section 54 of the Canadian Electric Code.

Lightning protection zones

The ‘rolling sphere method’ is used to determine where it is safe to mount equipment. An imaginary sphere, typically 50 meters in radius, is rolled over the structure. Where the sphere rests against the ground and a strike termination device (such as a finial or ground bar), all the space under the sphere is considered to be in the zone of protection (Zone B). Similarly, where the sphere rests on two finials, the space under the sphere is considered to be in the zone of protection.

Assess locations on masts, towers and buildings to determine if the location is in Zone A or Zone B:

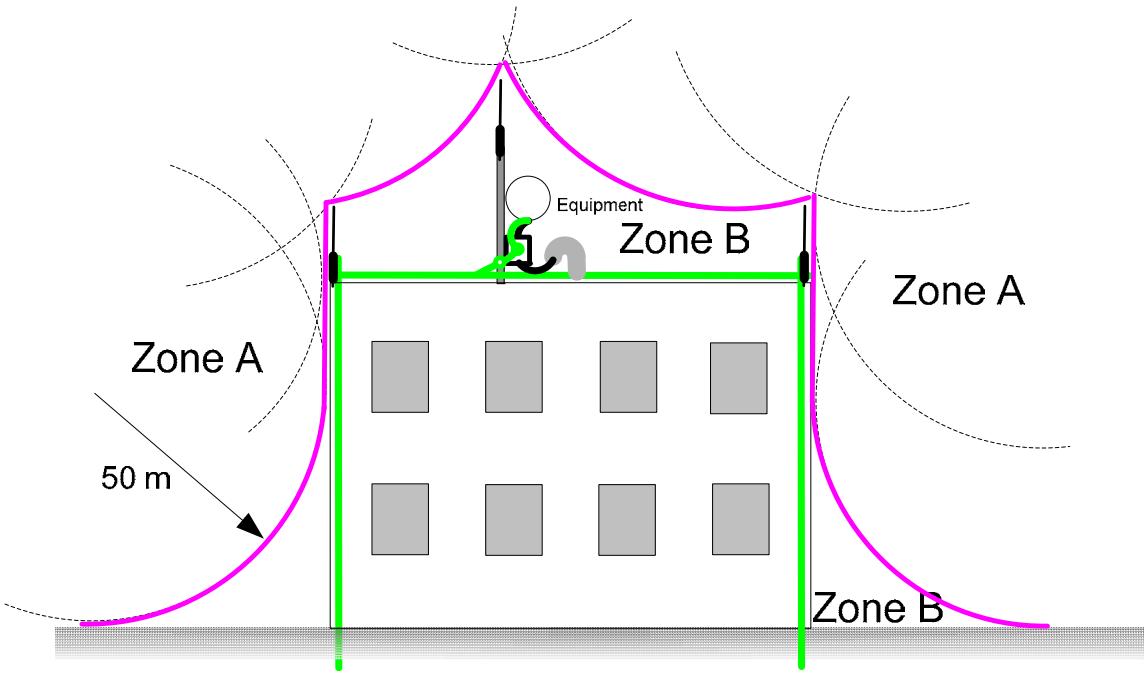
- Zone A: In this zone a direct lightning strike is possible. Do not mount equipment in this zone.
- Zone B: In this zone, direct EMD (lightning) effects are still possible, but mounting in this zone significantly reduces the possibility of a direct strike. Mount equipment in this zone.

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WARNING

Never mount equipment in Zone A. Mounting in Zone A may put equipment, structures and life at risk.

Figure 2-2 Rolling sphere method to determine the lightning protection zones



General protection requirements

To adequately protect a PTP 600 installation, both ground bonding and transient voltage surge suppression are required.

NOTE

Where an installation already has, or requires the use of a Master Ground Bar then the requirements of Motorola specification *R56: Standards And Guidelines For Communication Sites (68P81089E50)* take precedence over those in this guide. This specification is supplied on the PTP 600 CD-ROM.

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Basic requirements

The following basic protection requirements must be implemented:

- The equipment (ODU or GPS receiver for PTP-SYNC) must be in 'Zone B' (see Lightning protection zones on page 2-14).
- A lightning protection unit (LPU) must be installed within 600 mm (24 in) of the point at which the drop cable enters the building or equipment room.
- The drop cable must be bonded to the supporting structure in order to prevent lightning creating a potential between the structure and cable, which could cause arcing, resulting in damage to equipment.
- The drop cable must be grounded at the building entry point.
- The drop cable must not be laid alongside a lightning air terminal.
- All grounding cables must be a minimum size of 10 mm^2 csa (8AWG), preferably 16 mm^2 csa (6AWG), or 25 mm^2 csa (4AWG).

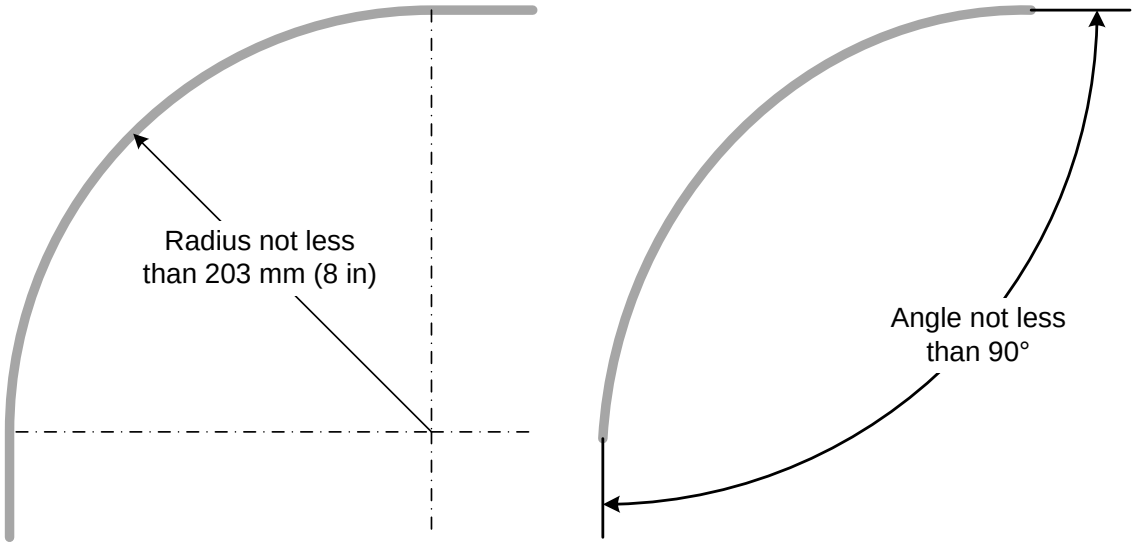
Grounding cable requirements

When routing, fastening and connecting grounding cables, the following requirements must be implemented:

- Grounding conductors must be run as short, straight, and smoothly as possible, with the fewest possible number of bends and curves.
- Grounding cables must not be installed with drip loops.
- All bends must have a minimum radius of 203 mm (8 in) and a minimum angle of 90° (Figure 2-3). A diagonal run is preferable to a bend, even though it does not follow the contour or run parallel to the supporting structure.
- All bends, curves and connections must be routed towards the grounding electrode system, ground rod, or ground bar.
- Grounding conductors must be securely fastened.
- Braided grounding conductors must not be used.
- Approved bonding techniques must be used for the connection of dissimilar metals.

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Figure 2-3 Grounding cable minimum bend radius and angle



ODU requirements

The following ODU protection requirements must be implemented:

- The ODU must be grounded to the supporting structure.
- An LPU must be installed close to the ODU.
- The distance between the ODU and LPU should be kept to a minimum.
- The drop cable length between the ODU and LPU must be less than 600 mm.
- The ODU and top LPU should be bonded together.

Protection requirements for a mast or tower installation

If the ODU is to be mounted on a metal tower or mast, then in addition to the general protection requirements (above), the following requirements must be observed:

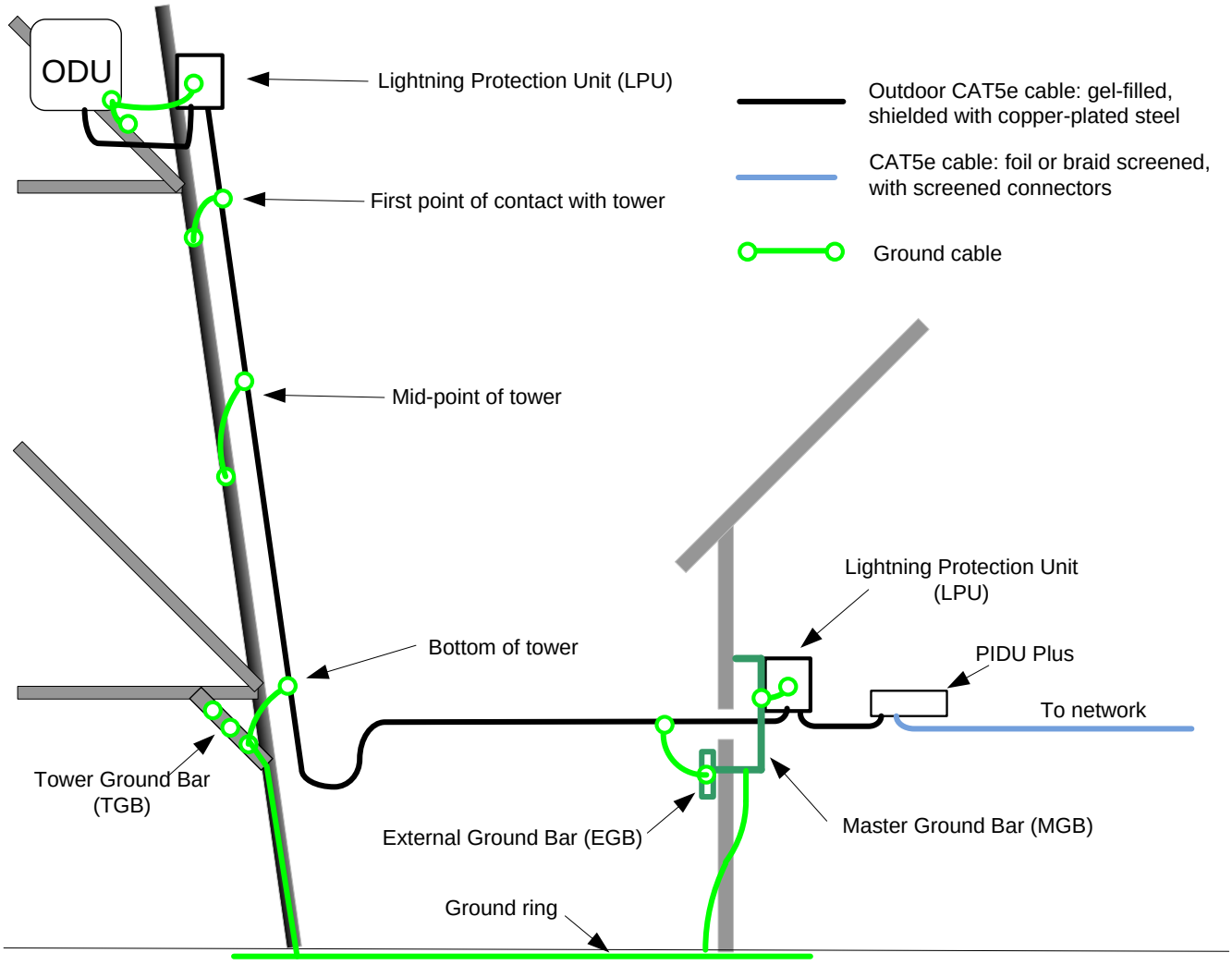
- The equipment must be lower than the top of the tower or its lightning air terminal.
- The metal tower or mast must be correctly grounded.
- A grounding kit must be installed at the first point of contact between the drop cable and the tower, near the top.
- A grounding kit must be installed at the bottom of the tower, near the vertical to horizontal transition point. This grounding kit must be bonded to the tower or tower ground bus bar (TGB), if installed.

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- If the tower is greater than 61 m (200 ft) in height, an additional grounding kit must be installed at the tower midpoint. Additional ground kits must be installed as necessary to reduce the distance between ground kits to 61 m (200 ft) or less.
- In high lightning prone geographical areas, additional ground kits should be installed at spacing between 15 to 22 m (50 to 75 ft). This is especially important on towers taller than 45 m (150 ft).

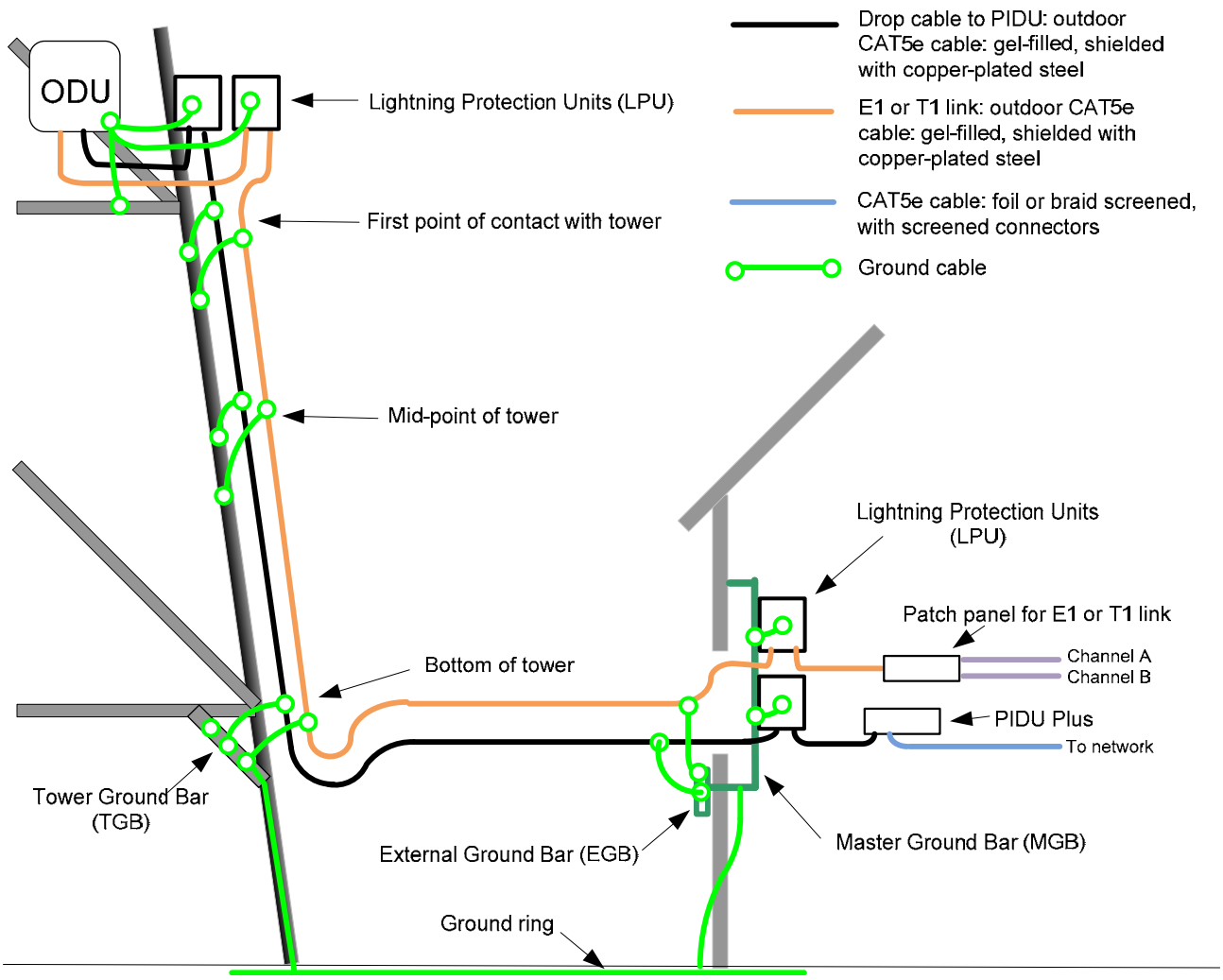
Schematic examples of mast or tower installations are shown in Figure 2-4 (basic configuration) and Figure 2-5 (E1 or T1 configuration).

Figure 2-4 Grounding and lightning protection on mast or tower



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Figure 2-5 Grounding and lightning protection on mast or tower (with E1 or T1)



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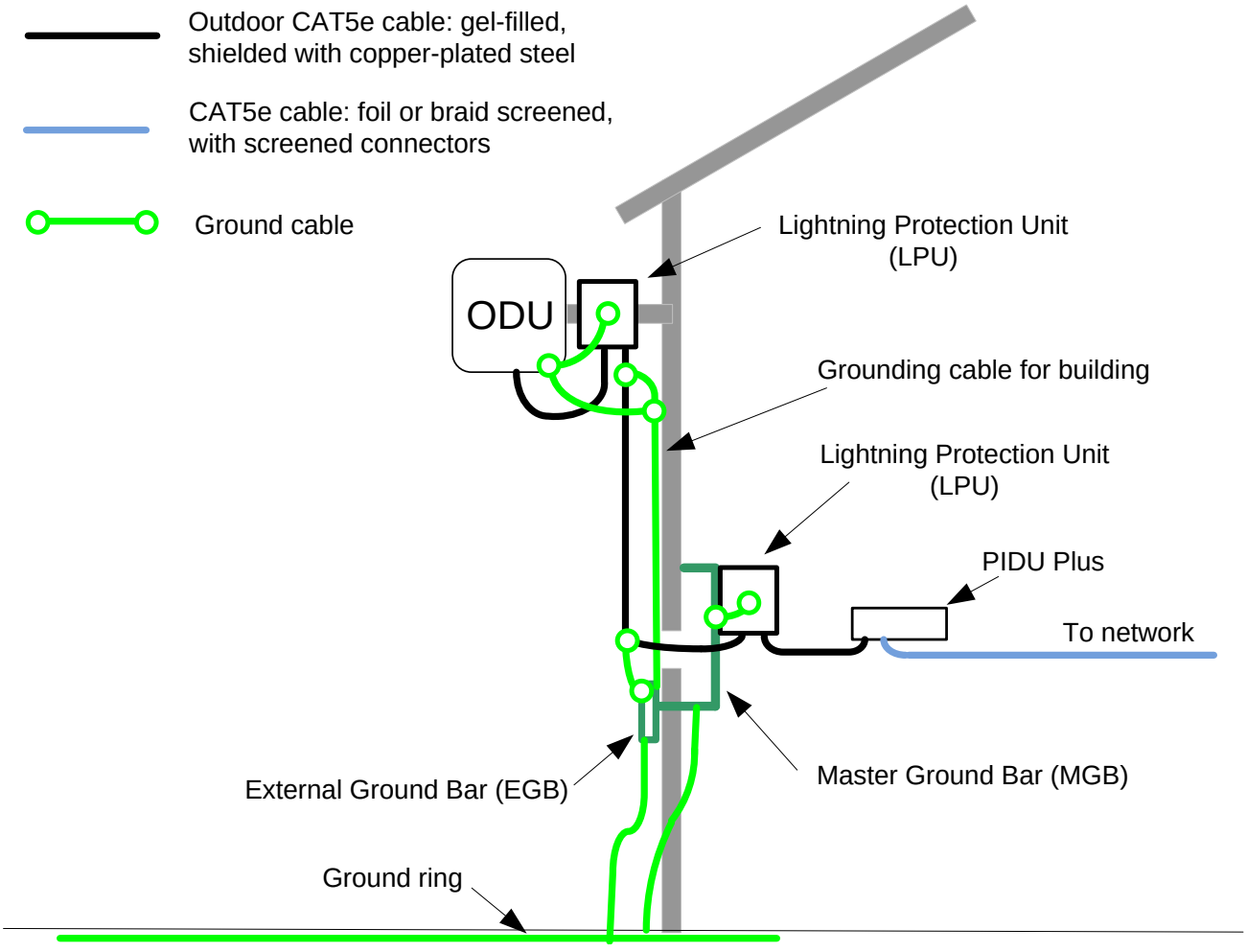
Protection requirements for a wall installation

If the ODU is to be mounted on the wall of a building, then in addition to the general protection requirements (above), the following requirements must be observed:

- The equipment must be lower than the top of the building or its lightning air terminal.
- The building must be correctly grounded.

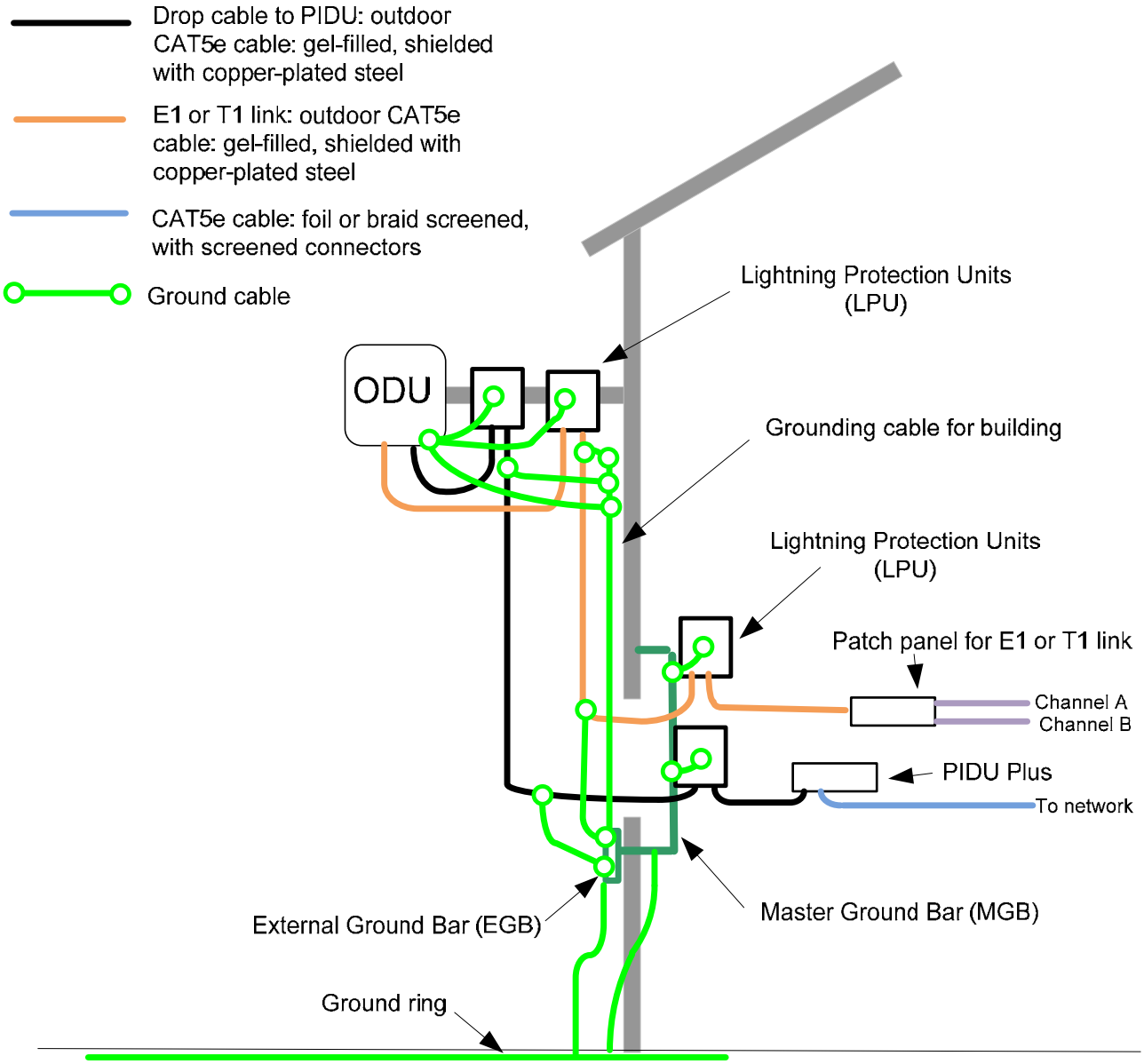
Schematic examples of wall installations are shown in Figure 2-6 (basic configuration) and Figure 2-7 (E1 or T1 configuration).

Figure 2-6 Grounding and lightning protection on wall



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Figure 2-7 Grounding and lightning protection on wall (with E1 or T1)



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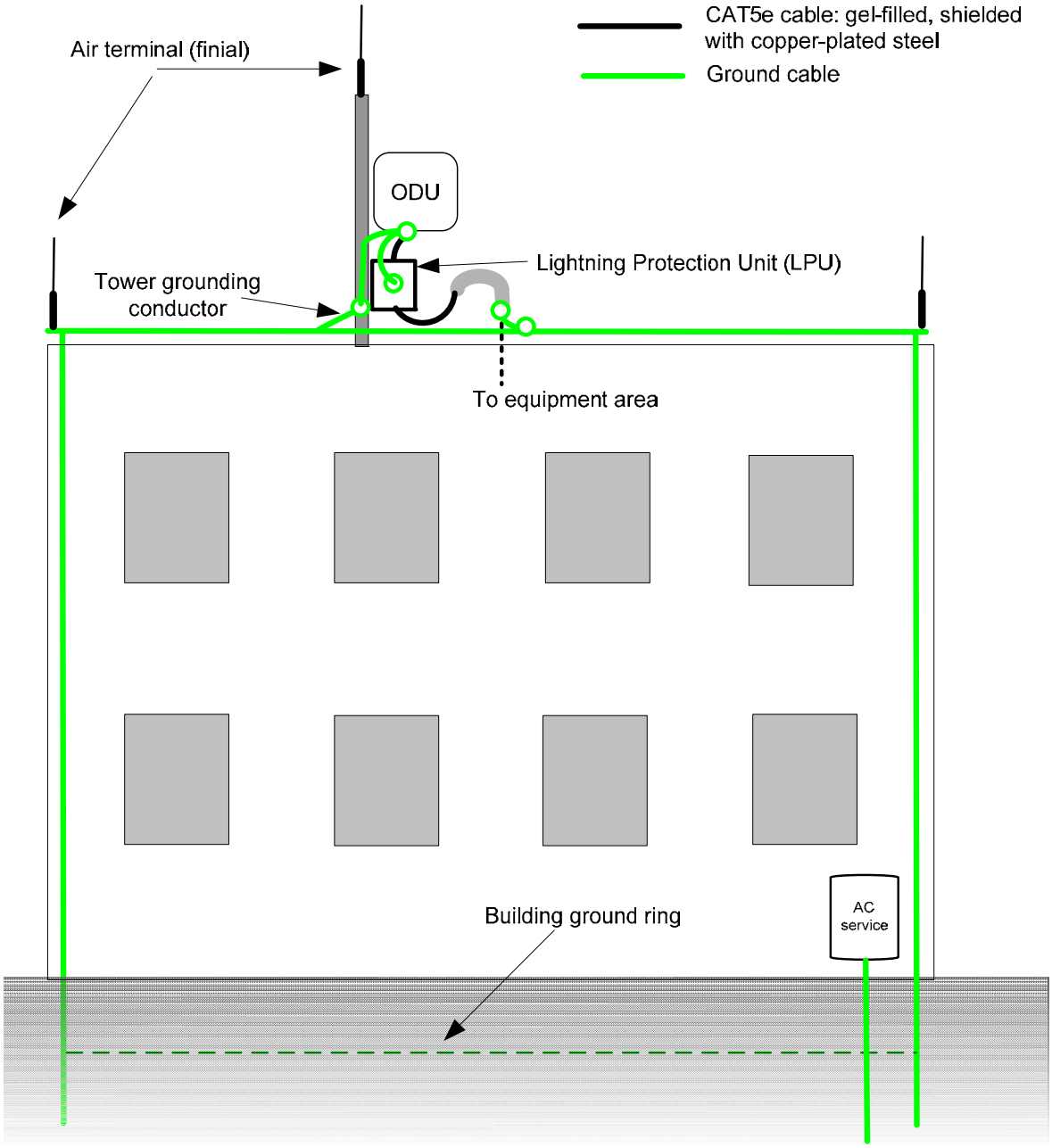
Protection requirements on a high rise building

If the ODU is to be mounted on a high rise building, it is likely that cable entry is at roof level (Figure 2-8) and the equipment room is several floors below (Figure 2-9). In addition to the general protection requirements (above), the following requirements must be observed:

- The ODU must be below the lightning terminals and finials.
- A grounding conductor must be installed around the roof perimeter, to form the main roof perimeter lightning protection ring.
- Air terminals are typically installed along the length of the main roof perimeter lightning protection ring typically every 6.1m (20ft).
- The main roof perimeter lightning protection ring must contain at least two down conductors connected to the grounding electrode system. The down conductors should be physically separated from one another, as far as practical.

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Figure 2-8 Grounding and lightning protection on building



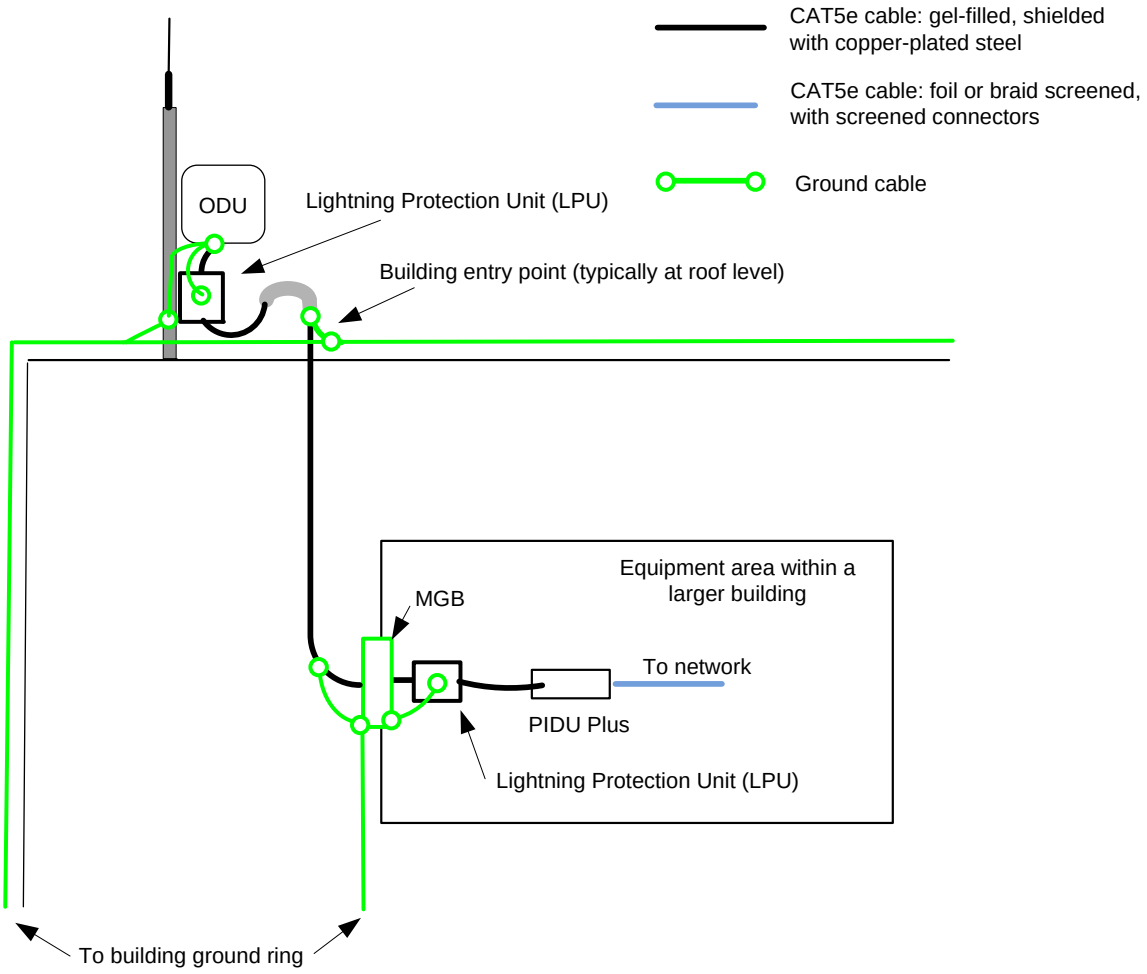
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Protection inside a high rise building

The following protection requirements must be observed inside multi-story or high rise buildings (Figure 2-9):

- The drop cable shield must be bonded to the building grounding system at the entry point to the building.
- The drop cable shield must be bonded to the building grounding system at the entry point to the equipment area.
- An LPU must be installed within 600 mm (24 in) of the entry point to the equipment area.

Figure 2-9 Grounding and lightning protection inside high building

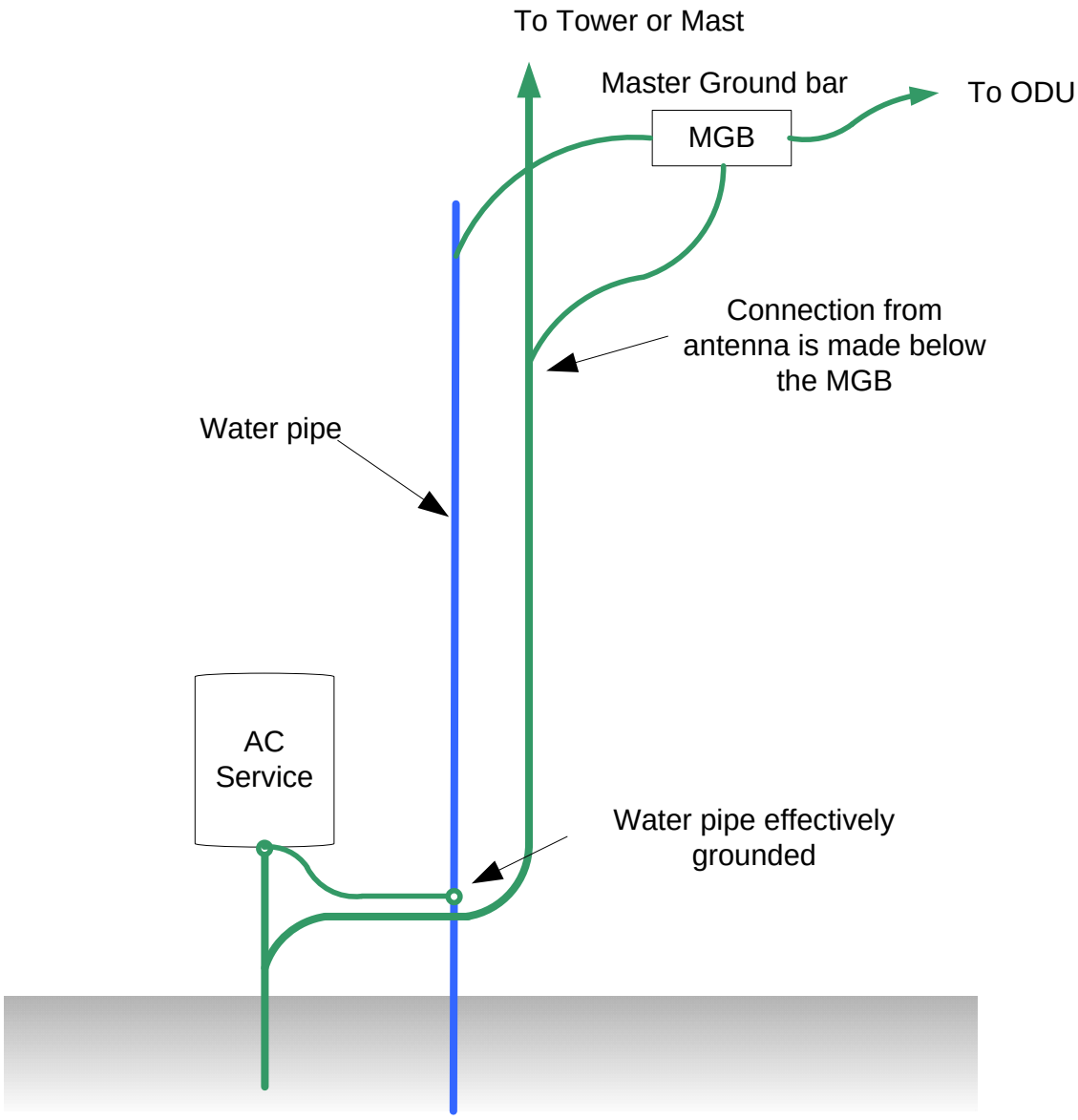


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Connecting to the grounding conductor

Figure 2-10 and Figure 2-11 illustrate the techniques employed to provide equipment grounding in high rise buildings. A steel component of the building can be used as a grounding conductor, provided it is part of the structural building steel and is effectively grounded.

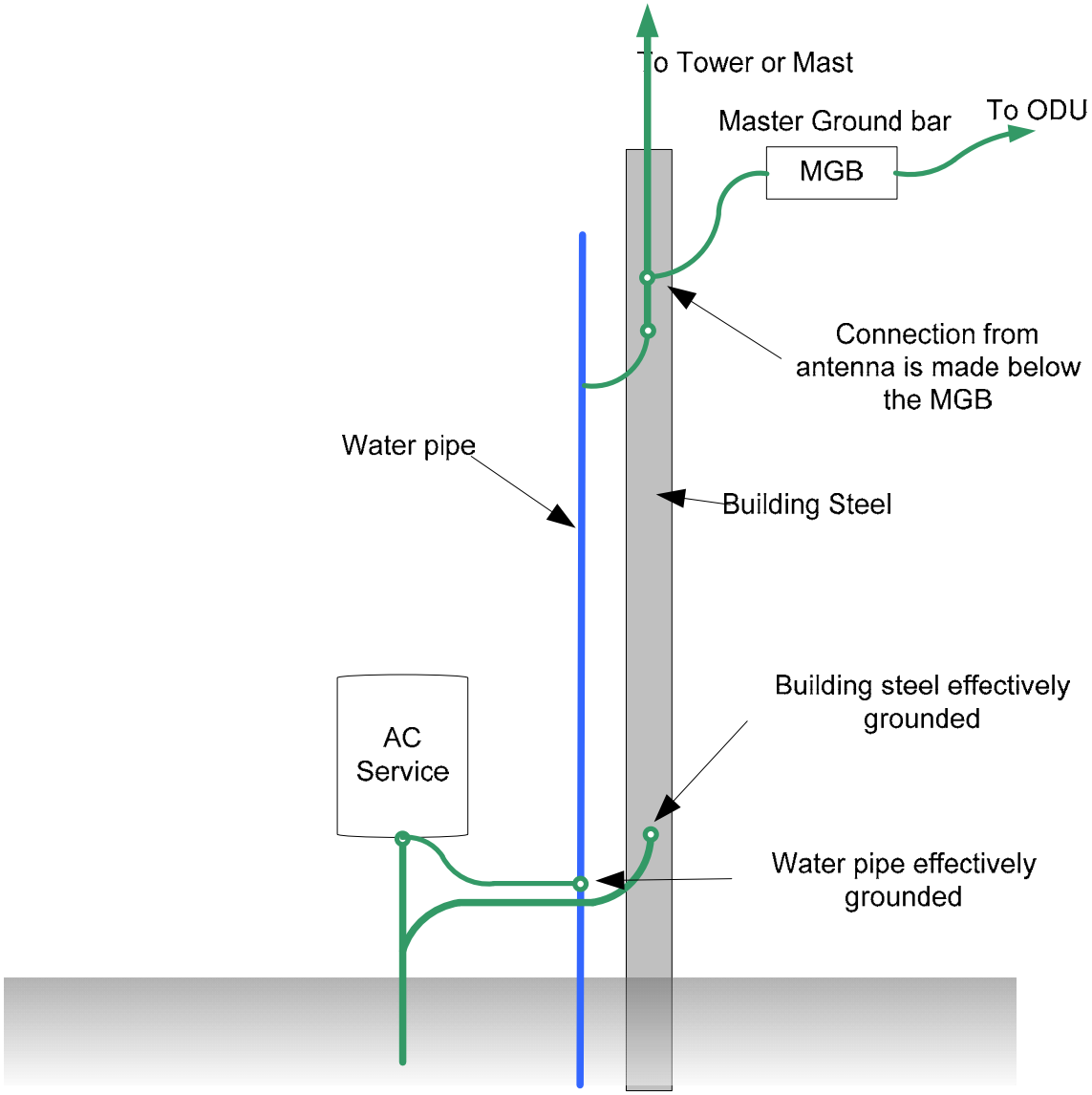
Figure 2-10 Grounding in a high rise building – building steel not available



ODU on different floor than AC service feed, building steel not available

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Figure 2-11 Grounding in a high rise building – building steel available



ODU on different floor than AC service feed, building steel available

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Configuration options for TDD synchronization

This section describes the different configuration options that may be used for implementing TDD synchronization in the PTP 600 Series. Schematic diagrams are included.

TDD synchronization configurations supported

The PTP 600 supports the following TDD synchronization configurations:

- Single link configuration with UltraSync.
- Single link configuration with PTP-SYNC.
- Cluster with PTP-SYNC and GPS receiver.
- Cluster with PTP-SYNC and no GPS receiver.

NOTE

If PTP-SYNC is the selected TDD synchronization method, select a 1 Hz timing reference for the system. This will normally be a GPS receiver module.

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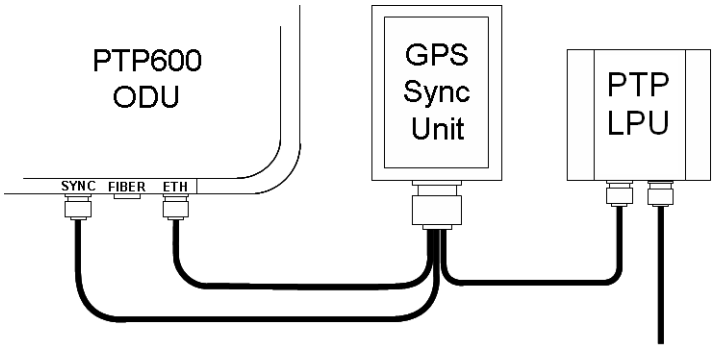
Single link configuration with UltraSync

Each link requires an UltraSync GPS receiver, connected at the master ODU (Figure 2-12).

The wireless configuration settings are:

- Master Slave Mode = ‘Master’.
- TDD Sync Device = ‘UltraSync’.

Figure 2-12 TDD synchronization configuration – standalone with UltraSync



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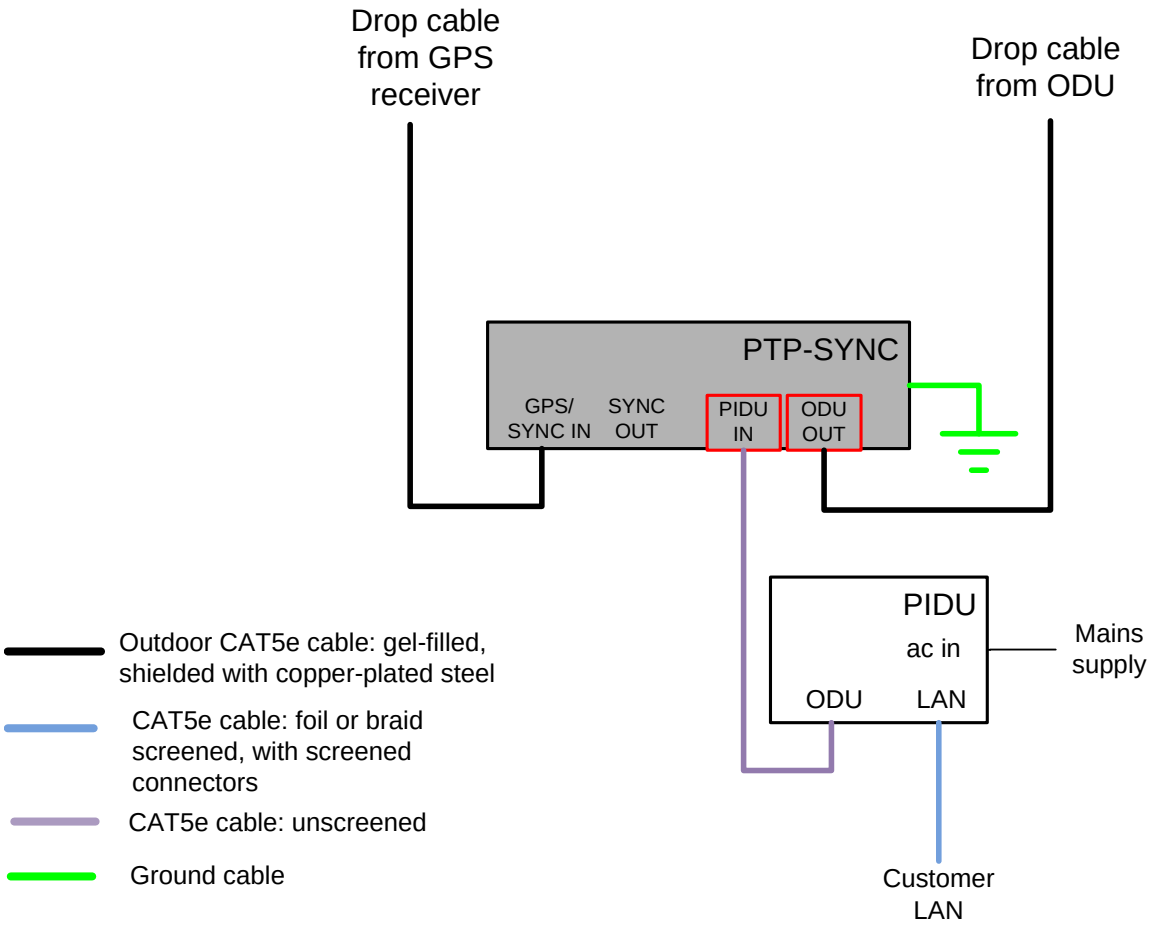
Single link configuration with PTP-SYNC

Each link requires one PTP-SYNC unit connected to the master ODU and one compatible GPS receiver. Use this configuration where a site contains only one TDD master ODU. The GPS receiver and LPU can be replaced by an alternative compatible 1 Hz timing reference (Figure 2-13).

The wireless configuration settings are:

- Master Slave Mode = ‘Master’.
- TDD Sync Device = ‘PTPSYNC’.
- Cluster Master Slave = ‘Cluster Master’.
- PTP Sync Site Reference = ‘GPS/1PPS External’.

Figure 2-13 TDD synchronization configuration – single link with PTP-SYNC



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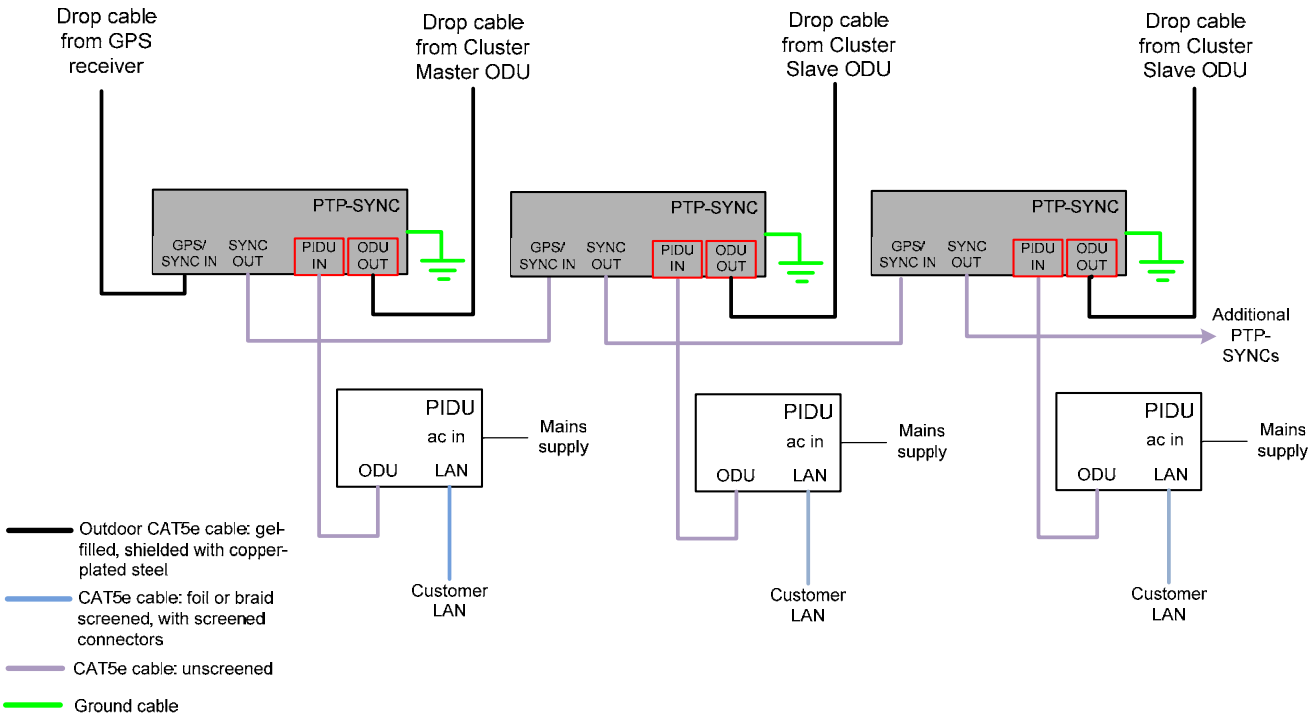
Cluster with PTP-SYNC and GPS receiver

Each link requires one PTP-SYNC unit. Each site requires one compatible GPS receiver. Collocated PTP-SYNC units are connected together in a daisy-chain. Between two and ten PTP-SYNCs may be chained in this way. Use this configuration where a site contains collocated TDD master ODUs in an extended network and where multiple sites have TDD master ODUs (Figure 2-14).

The wireless configuration settings are:

- Master Slave Mode = ‘Master’ (all ODUs in cluster).
- TDD Sync Device = ‘PTPSYNC’ (all ODUs in cluster).
- Cluster Master Slave = ‘Cluster Master’ (first ODU) and ‘Cluster Slave’ (others).
- PTP Sync Site Reference = ‘GPS/1PPS External’ (all ODUs in cluster).

Figure 2-14 TDD synchronization configuration – cluster with PTP-SYNC and GPS



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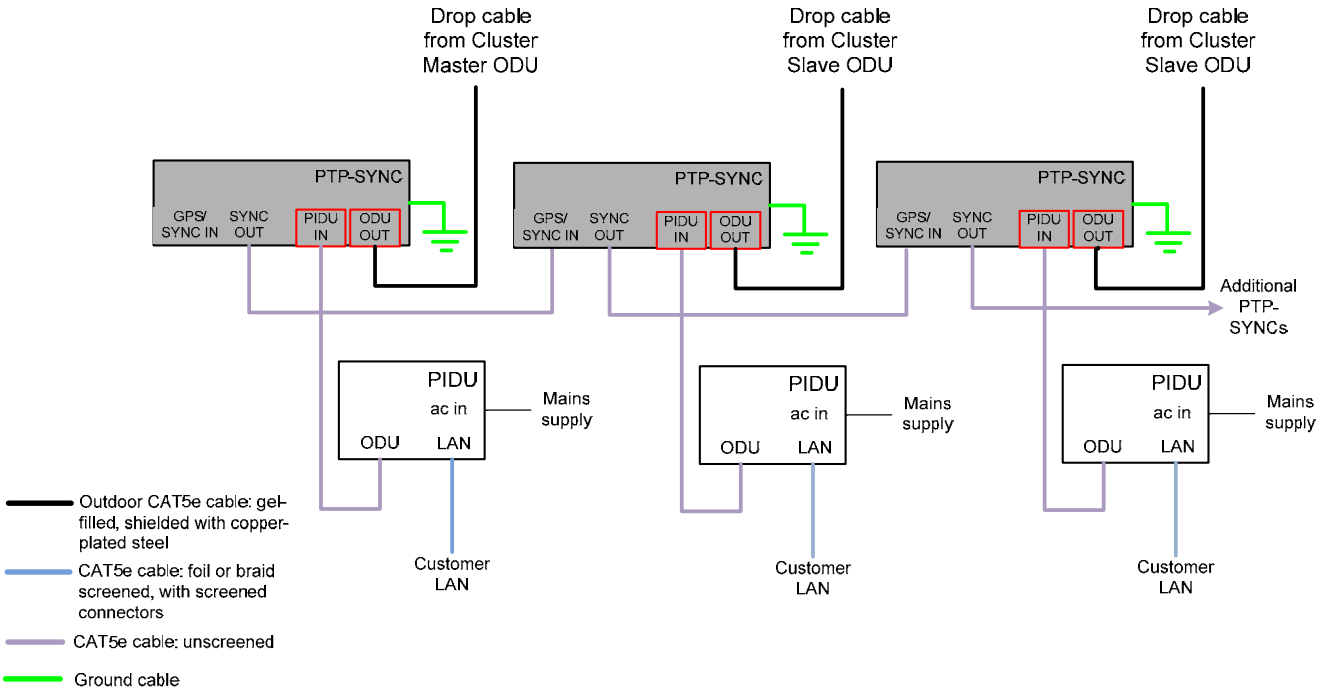
Cluster with PTP-SYNC and no GPS receiver

Each link requires one PTP-SYNC unit. PTP-SYNC units are connected together in a daisy-chain. Between two and ten PTP-SYNCs may be chained in this way. One ODU is designated as a cluster timing master. Use this configuration where all master ODUs are collocated at a single site. As this configuration does not require a GPS receiver, it provides additional flexibility, particularly in applications requiring rapid deployment (Figure 2-15).

The wireless configuration settings are:

- Master Slave Mode = ‘Master’ (all ODUs in cluster).
- TDD Sync Device = ‘PTPSYNC’ (all ODUs in cluster).
- Cluster Master Slave = ‘Cluster Master’ (first ODU) and ‘Cluster Slave’ (others).
- PTP Sync Site Reference = ‘Internal’ (all ODUs in cluster).

Figure 2-15 TDD synchronization configuration – cluster with PTP-SYNC and no GPS



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Mounting options for the PTP-SYNC GPS receiver

If PTP-SYNC is the selected TDD synchronization method, with a GPS receiver as the timing reference source, then the GPS receiver must be mounted as described in this section.

⚠ CAUTION

Ensure that the GPS receiver module is mounted in a position where all protection requirements can be met.

GPS receiver location requirements

The GPS receiver for PTP-SYNC must be mounted at a location that meets the following requirements:

- It must be possible to protect the installation as described in General protection requirements on page 2-15.
- It must have an un-interrupted view of the sky.
- It must receive an adequate signal from at least four GPS satellites.
- It must be mounted at least 1 m (3 ft), preferably 2 m (6 ft), away from other GPS receiving equipment.
- It must not be sited in the field of radiation of co-located radio communications equipment and should be positioned at a distance of at least 3 m (10 ft) away.

Mount the GPS receiver on the wall of the equipment building, if there is a suitable location on the wall that can meet these requirements. Failing that, mount it on a metal tower or mast.

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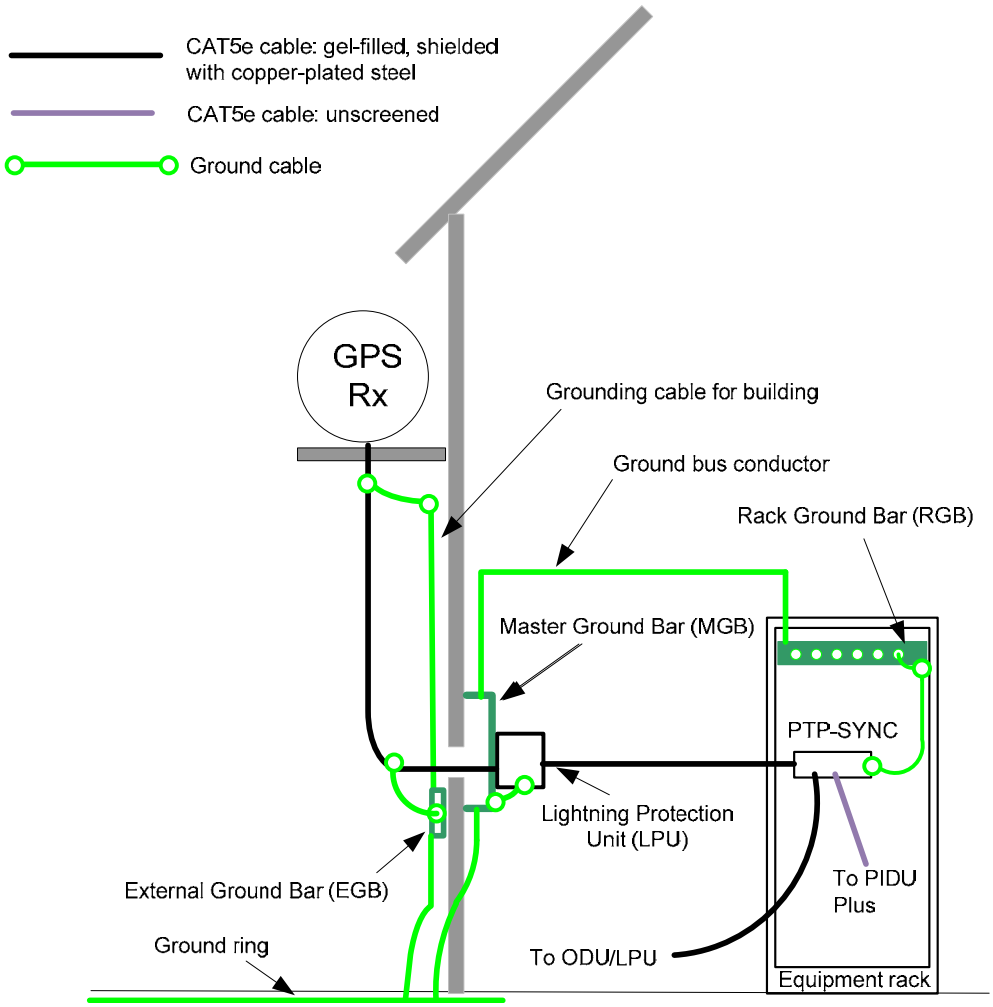
Mounting the GPS receiver module on the equipment building

If mounting the GPS receiver for PTP-SYNC on the equipment building (Figure 2-16), select a position on the wall that meets the following requirements:

- It must be below the roof height of the equipment building or below the height of any roof-mounted equipment (such as air conditioning plant).
- It must be below the lightning air terminals.
- It must not project more than 600mm (24 inches) from the wall of the building.

If these requirements cannot all be met, then the module must be mounted on a metal tower or mast.

Figure 2-16 Grounding and lightning protection for GPS receiver on building



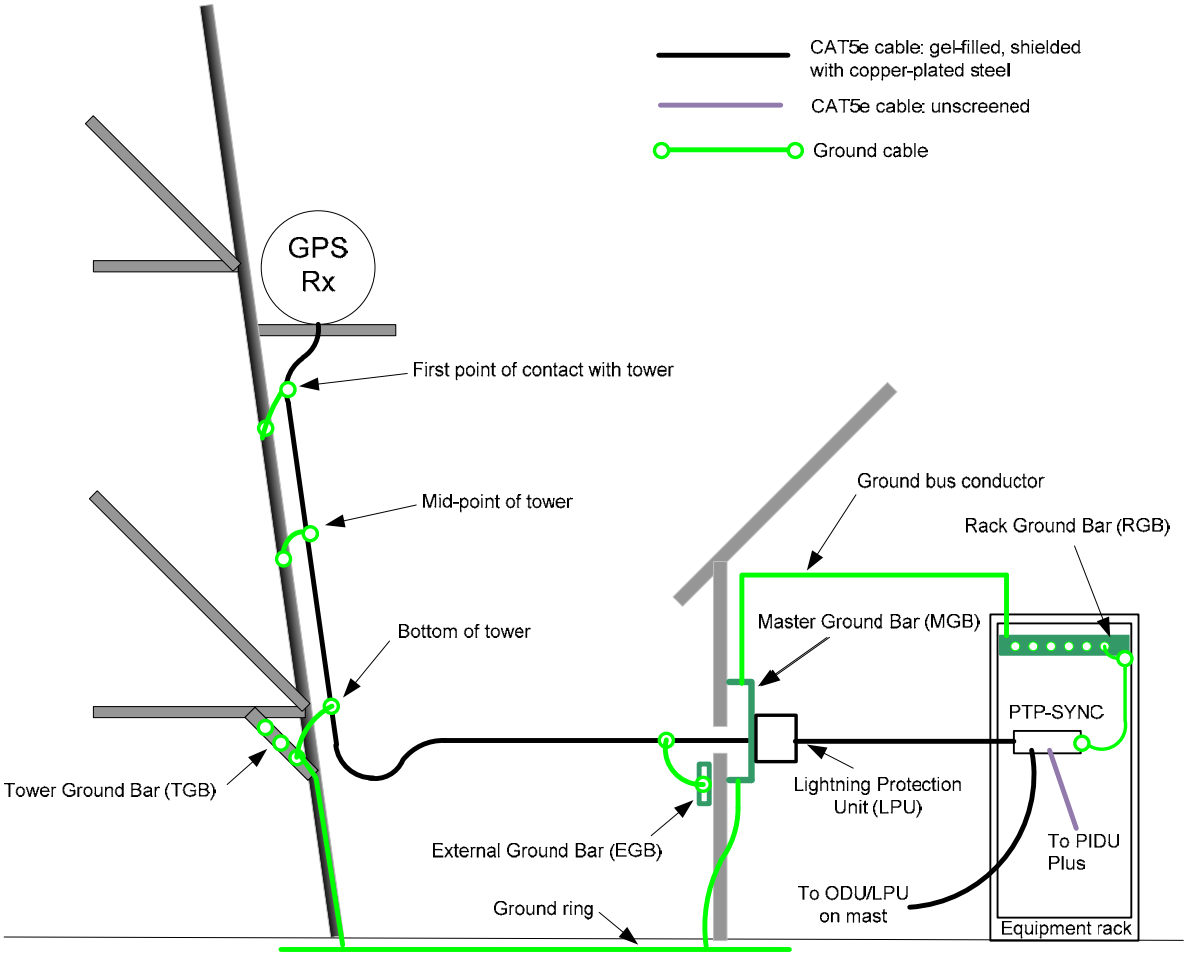
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Mounting the GPS receiver module on a metal tower or mast

If mounting the GPS receiver module on a metal tower or mast (Figure 2-17), select a position that meets the following requirements:

- It must not be mounted any higher than is necessary to receive an adequate signal from four GPS satellites.
- It must be protected by a nearby lightning air terminal that projects further out from the tower than the GPS receiver module.
- It must meet all the requirements stated in Protection requirements for a mast or tower installation on page 2-17.

Figure 2-17 Grounding and lightning protection for GPS receiver on tower or mast



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Data network planning

Management mode

Decide how the PTP 600 will be managed.

In the default in-band management mode, the management agent can be reached from the Ethernet port at the local ODU, and (assuming that the wireless link is established) from the Ethernet port at the remote ODU.

In the alternative in-band local management mode, the IP interface of the management agent is always connected in a VLAN, and Ethernet frames in this management VLAN are filtered (discarded) at the wireless port. Use the in-band local management mode in networks that require only local access to the ODU management agent. For correct operation of in-band local management mode, ensure that the same management VLAN ID is configured at both ends of the link.

Make sure that the same management mode is selected for ODUs at both ends of a link. See Management network on page 1-37 for further explanation of management modes.

VLAN membership

Decide if the IP interface of the ODU management agent will be connected in a VLAN. If so, decide if this is a standard (IEEE 802.1Q) VLAN or provider bridged (IEEE 802.1ad) VLAN, and select the VLAN ID for this VLAN.

Use of a separate management VLAN is strongly recommended. Use of the management VLAN helps to ensure that the ODU management agent cannot be accessed by customers.

The in-band local management mode is not available unless the IP interface is connected in a VLAN.

Priority for management traffic

Choose the Ethernet priority for management traffic generated within the ODU management agent. The priority should be selected so as to be consistent with existing policy on priority of management traffic in the network. Use of a high priority is strongly recommended to ensure that management traffic is not discarded if the link is overloaded.

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IP interface

Choose an IP address for the IP interface of the ODU management agent. The IP address must be unique and valid for the connected network segment and VLAN.

Find out the correct subnet mask and gateway IP address for this network segment and VLAN.

Ensure that the design of the data network permits bi-direction routing of IP datagrams between network management systems and the ODUs. For example, ensure that the gateway IP address identifies a router or other gateway that provides access to the rest of the data network.

Quality of service for bridged Ethernet traffic

Choose an appropriate assignment between the priority code point in bridged Ethernet frames and PTP 600 traffic classes. This assignment should be consistent with quality of service policy in the rest of the customer data network.

The user interface provides a convenient shortcut to select the assignment recommended in IEEE 802.1Q-2005.

NOTE

Ethernet priority information is coded in the Ethernet VLAN tag and differentiated quality of service is therefore not available in a network based on untagged Ethernet frames.

Back to back links

Avoid the use of direct cabled connections between two PIDUs. Where two or more links are deployed in a chain, always use an Ethernet switch or router to interconnect the links at a relay point.

‘Green Ethernet’ switches

Do not connect PTP 600 units to Ethernet networking products that control the level of the transmitted Ethernet signal based on the measured length of the Ethernet link, for example Green Ethernet products manufactured by D-Link Corporation. The Ethernet interfaces in these networking products do not work correctly when connected directly to the PTP 600 PIDU.

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Security planning

Planning for HTTPS / TLS operation

Before starting to configure HTTPS/TLS operation, ensure that the cryptographic material listed in Table 2-3 is available.

Table 2-3 HTTPS/TLS security material

Item	Description	Quantity required
Key of Keys	An encryption key generated using a cryptographic key generator. The key length is dictated by the installed license key. License keys with AES-128 will require a key of keys of 128-bits. License keys with AES-256 will require a key of keys of 256-bits. The key output should be in ASCII hexadecimal characters.	Two per link. For greater security, each link end should be allocated a unique Key of Keys.
TLS Private Key and Public Certificates	An RSA private key of size 1024, generated in either PKCS#1 or PKCS#5 format, unencrypted, and encoded in the ASN.1 DER format. An X.509 certificate containing an RSA public key, generated in either PKCS#1 or PKCS#5 format, unencrypted, and encoded in the ASN.1 DER format. The public key certificate must form a valid pair with the private key.	Two pairs per link. These items are unique to IP address.
User Defined Security Banner	The purpose of this banner is to tell users that the system is secure. Use text that is appropriate to the network security policy.	Normally one per link. This depends upon network policy.
Entropy Input	This must be of size 512 bits (128 hexadecimal characters), output from a random number generator.	Two per link. For greater security, each link end should be allocated a unique Entropy Input.

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Item	Description	Quantity required
Wireless Link Encryption Key for AES	An encryption key generated using a cryptographic key generator. The key length is dictated by the selected AES encryption algorithm (128 or 256 bits).	One per link. The same encryption key is required at each link end.
Port numbers for HTTP, HTTPS and Telnet	Port numbers allocated by the network.	As allocated by network.

Planning for FIPS 140-2 operation

If the link is to operate in FIPS 140-2 secure mode, ensure that the following cryptographic material is generated using a FIPS-approved cryptographic generator:

- Key of Keys
- TLS Private Key and Public Certificates
- Entropy Input
- Wireless Link Encryption Key for AES

Ensure that the web browsers used are enabled for HTTPS/TLS operation using FIPS-approved cipher specifications.

Ensure that following attributes of user accounts for the web-based management interface have been configured to match the operator’s network security policy:

- Auto Logout Period.
- Maximum Number of Login Attempts.
- Login Attempt Lockout.
- Minimum Password Change Period.
- Password Expiry Period.
- Webpage Session Control

Ensure that the following are configured:

- Identity-based user accounts = Enabled.
- Password complexity rules reset to ‘best practice’ values.
- Security Officer passwords compliant with the network security policy.
- RADIUS authentication = Disabled.

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⚠ CAUTION

Configure all of the above correctly to ensure that PTP 600 is operating in compliance with the FIPS 140-2 validation.

Planning for SNMP operation

Supported notifications

The supported notifications are as follows:

- Cold start
- Wireless Link Up/Down
- DFS Channel Change
- DFS Impulse Interference
- Authentication Failure
- Ethernet Link Up/Down

Supported MIBs

Ensure that the following MIBs are loaded on the network management system.

- RFC-1493. BRIDGE-MIB
- RFC-2233. IF-MIB
- RFC-3411. SNMP-FRAMEWORK-MIB
- RFC-3412. SNMP-MPD-MIB
- RFC-3413. SNMP-TARGET-MIB
- RFC-3414. SNMP-USER-BASED-SM-MIB
- RFC-3415. SNMP-VIEW-BASED-ACM-MIB
- RFC-3418. SNMPv2-MIB
- RFC-3826. SNMP-USM-AES-MIB
- PTP 600 Series proprietary MIB

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Supported alarms

PTP 600 supports the following diagnostic alarms:

- Region Code
- Install Status
- Install Arm State
- Unit Out Of Calibration
- Incompatible Region Codes
- Incompatible Master And Slave
- Ethernet Configuration Mismatch
- No Wireless Channel Available
- SNTP Synchronization Failed
- Wireless Link Disabled Warning
- Ethernet Link Disabled Warning
- Ethernet Link Status
- Fiber Link Status
- Telecoms Channel A Status
- Telecoms Channel B Status
- Telecoms Channel A Loopback
- Telecoms Channel B Loopback
- TDD Synchronization Alarm
- Link Mode Optimization Mismatch

The web-based interface may be used to enable or disable generation of each supported SNMP notification or diagnostic alarm.

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Enabling SNMP

Enable the SNMP interface for use by configuring the following attributes in the Remote Management page:

- SNMP State (default disabled)
- SNMP Version (default SNMPv1/2c)
- SNMP Port Number (default 161)

When the SNMP Version is set to SNMPv1/2c the interface must be additionally configured by entering the following attributes:

- SNMP Trap IP Address
- SNMP Trap Port Number
- SNMP Community String

Planning for SNMPv3 operation

SNMP security mode

Decide how SNMPv3 security will be configured.

MIB-based security management uses standard SNMPv3 MIBs to configure the user-based security model and the view-based access control model. This approach provides considerable flexibility, allowing a network operator to tailor views and security levels appropriate for different types of user. MIB-based security management may allow a network operator to take advantage of built-in security management capabilities of existing network managers.

Web-based security management allows an operator to configure users, security levels, privacy and authentication protocols, and passphrases using the PTP 600 web-based management interface. The capabilities supported are somewhat less flexible than those supported using the MIB-based security management, but will be sufficient in many applications. Selection of web-based management for SNMPv3 security disables the MIB-based security management. PTP 600 does not support concurrent use of MIB-based and web-based management of SNMPv3 security.

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Web-based management of SNMPv3 security

Initial configuration of SNMPv3 security is available only to HTTP or HTTPS/TLS user accounts with security role of Security Officer.

Identify the minimum security role of HTTP or HTTPS/TLS user accounts that will be permitted access for web-based management of SNMPv3 security. Two roles are available:

- System Administrator
- Security Officer

Identify the format used for SNMP Engine ID. Three formats are available:

- MAC address (default)
- IP address
- Text string

If SNMP Engine ID will be based on a text string, identify the text string required by the network management system. This is often based on some identifier that survives replacement of the PTP hardware.

Identify the user names and security roles of initial SNMPv3 users. Two security roles are available:

- Read Only
- System Administrator

Identify the security level for each of the security roles. Three security levels are available:

- No authentication, no privacy
- Authentication, no privacy
- Authentication, privacy

If authentication is required, identify the protocol. Two authentication protocols are available:

- MD5
- SHA

If privacy will be used, identify the protocol. Two privacy protocols are available:

- DES
- AES

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AES link encryption is only available to users who have purchased an appropriate license key.

If authentication or authentication and privacy protocols are required, identify passphrases for each protocol for each SNMP user. It is considered good practice to use different passphrases for authentication and privacy. Passphrases must have length between 8 and 32 characters, and may contain any of the characters listed in Table 2-4.

Table 2-4 Permitted character set for SNMPv3 passphrases

Character	Code	Character	Code
<space>	32	;	59
!	33	<	60
“	34	=	61
#	35	>	62
$	36	?	63
%	37	@	64
&	38	A..Z	65..90
'	39	[	91
(	40	\	92
)	41	]	93
*	42	^	94
+	43	_	95
,	44	`	96
-	45	a..z	97..122
.	46	{	123
/	47	|	124
0..9	48..57	}	125
:	58	~	126

Identify up to two SNMP users that will be configured to receive notifications (traps). Identify the IP address and UDP port number of the associated SNMP manager.

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- Motorola Inc. end user license agreement on page 3-2
- Hardware warranty on page 3-23
- Limit of liability on page 3-24

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glennrp at users.sourceforge.net

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Julian Seward, jseward@bzip.org

USB library functions

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Chapter 4 Reference information

This chapter describes the reference information and regulatory notices that are common to all PTP 600 products and those that are specific to each frequency variant.

The following topics are described in this chapter:

- Installation inventories on page 4-2
- ODU specifications on page 4-12
- PIDU Plus specifications on page 4-14
- Cable and connector specifications on page 4-16
- Antenna specifications on page 4-18
- PTP-SYNC specifications on page 4-26
- Wireless specifications on page 4-29
- Data network specifications on page 4-76
- System management data on page 4-77
- Safety compliance on page 4-89
- Electromagnetic compliance on page 4-90
- Notifications on page 4-107
- Data rate calculations on page 4-114

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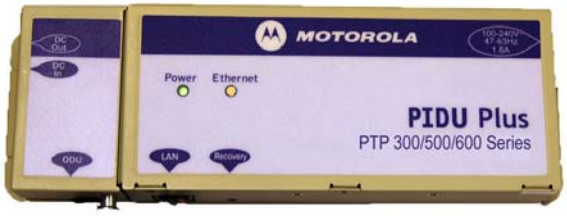
Installation inventories

This section contains inventories of the components required, both for standard PTP 600 bridge installations and for the main installation options, such as connectorized ODUs, PTP-SYNC, GPS and E1 or T1.

Inventory for standard installations

A standard PTP 600 Series bridge installation requires the components listed in Table 4-1.

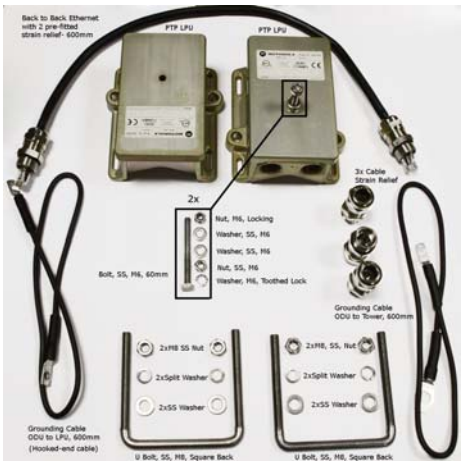
Table 4-1 Standard PTP 600 Series bridge components

Item	Notes
Outdoor unit (ODU) - integrated 	Pre-fitted with a mounting bracket and earth bonding leads. Two required per link. Refer to ODU specifications on page 4-12.
PIDU Plus 	Supplied with mains power lead. Two required per link. Refer to PIDU Plus specifications on page 4-14.

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Item	Notes
Outdoor drop cable 	Purchase separately. **⚠ CAUTION** Always use Cat5e cable that is gel-filled and shielded with copper-plated steel. Alternative types of drop cable are not supported by Motorola. Refer to Cable and connector specifications on page 4-16.
Outdoor connectors and glands	Purchase separately. Refer to Cable and connector specifications on page 4-16.
Indoor CAT5e cable	Purchase separately. Refer to Cable and connector specifications on page 4-16.
Cable grounding kits for 1/4” and 3/8” cable 	Motorola part number 01010419001. One per drop cable grounding point. Kit contents: grounding cable, self-amalgamating tape, PVC tape, tie-wraps, bolts, washers and nuts.

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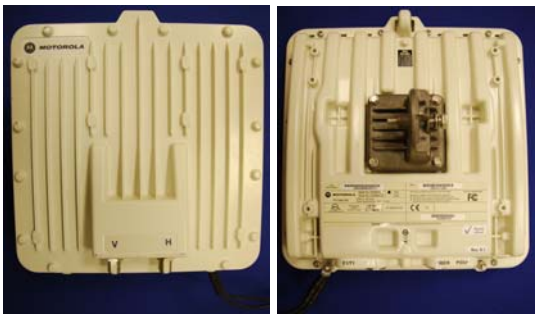
Item	Notes
Lightning Protection Unit (LPU) double end kit 	Motorola part number WB2907C. Two kits required per standard link (total four LPUs). Kit contents: two LPUs, grounding cables, 600mm ODU to LPU cable, nuts, bolts and glands.
Cable ties 	Purchase separately.

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Inventory for connectorized bridge installations

A connectorized PTP 600 Series bridge installation requires all of the standard installation components (apart from the integrated ODU). It also requires the components listed in Table 4-2.

Table 4-2 Connectorized PTP 600 Series bridge components

Item	Notes
Outdoor unit (ODU) - connectorized 	Pre-fitted with a mounting bracket and earth bonding leads. Two required per link. Refer to ODU specifications on page 4-12.
Antenna	Purchase separately. Only required for connectorized ODUs. Refer to Antenna specifications on page 4-18.
RF cable	Purchase separately. For connecting the ODU to the antenna. May be cable of type LMR100, LMR200, LMR300, LMR400 or LMR600. Cable losses are specified in Table 4-79. **NOTE** A cable of a type similar to LMR400 is a lot more difficult to handle and route than a cable of a type similar to LMR100.

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Item	Notes
RF cable connectors	Purchase separately. N type male connectors are required for connecting the RF cable to the ODU. For the antenna end of the RF cable, refer to the antenna manufacturer's instructions. Use weatherproof connectors, preferably ones that are supplied with adhesive lined heat shrink sleeves that are fitted over the cable/connector interface.
Cable ties, cable cleats	Purchase separately. For securing cables.
Self-amalgamating tape	Purchase separately. To weatherproof the RF connectors.
PVC tape	Purchase separately. For additional protection of the RF connectors and securing cable.

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Inventory for UltraSync installations

A PTP 600 Series bridge installation with UltraSync GPS requires all of the standard installation components (Table 4-1), with the addition of one MemoryLink UltraSync GPS-100M kit (Motorola part number WB3001) (Figure 4-1).

Figure 4-1 UltraSync unit



The kit contains the following components:

- GPS synchronization unit.
- Three attached terminated Ethernet and sync cables and cable glands.
- Mounting bracket and mounting bracket bolts.
- Outdoor rated UV resistant cable tie.
- UltraSync user manual.

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Inventory for PTP-SYNC installations

A PTP-SYNC installation requires the components listed in Table 4-3. All of these components must be purchased separately.

Table 4-3 PTP-SYNC installation components

Item	Notes
PTP-SYNC kit 	Motorola part number WB3665. Kit contents: 1 x PTP-SYNC unit 1 x M4 pan screw 2 x M4 washers 2 x M3 (6mm) torx drive screws 1 x lug for unit ground (cable not supplied) Refer to PTP-SYNC specifications on page 4-26.
Indoor CAT5e cable	To connect the PTP-SYNC to the PIDU Plus. Can be any standard screened or unscreened CAT5e cable.

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Item	Notes
PTP800 CMU / PTP-SYNC 19” rack mount installation kit 	Motorola part number WB3486. Required for rack-mounted PTP-SYNC units. Kit contents: 1 x rack bracket 8 x M3 washers 8 x M3 screws 1 x rack mount blank plate 8 x M5 nuts 8 x M5 washers 2 x rack handles Refer to PTP-SYNC specifications on page 4-26.

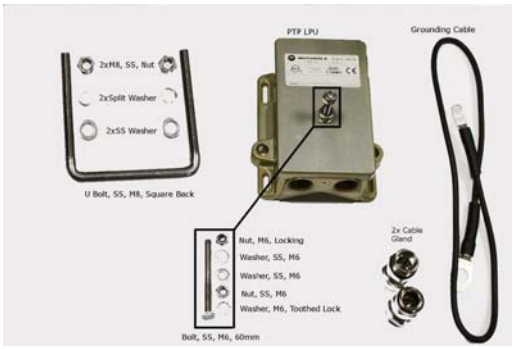
Inventory for GPS receiver installations

A GPS receiver installation (for PTP-SYNC) requires the components listed in Table 4-4. All of these components must be purchased separately.

Table 4-4 GPS receiver installation components

Item	Notes
Trimble Acutime™ Gold GPS receiver	Motorola part number STLN6594.
Outdoor drop cable	⚠ CAUTION Always use Cat5e cable that is gel-filled and shielded with copper-plated steel. Alternative types of drop cable are not supported by Motorola. Superior Essex BBDGe is suitable. Refer to Cable and connector specifications on page 4-16.

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Item	Notes
Connectors and glands for LPU	Use the recommended connectors and glands to connect the drop cable to the LPU. Refer to Outdoor connectors and glands on page 4-16.
Connectors and glands for GPS	Use the recommended connectors and glands to connect the drop cable to the Trimble GPS receiver. Refer to Outdoor connectors and glands – Trimble GPS on page 4-17.
Cable grounding kits for 1/4” and 3/8” cable 	Motorola part number 01010419001. One per drop cable grounding point. Kit contents: grounding cable, self-amalgamating tape, PVC tape, tie-wraps, bolts, washers and nuts.
Lightning Protection Unit (LPU) single end kit 	Motorola part number WB2978C. For protecting the connection to the GPS receiver. Kit contents: LPU, grounding cable, nuts, bolts and glands.

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Inventory for E1 or T1 installations

A PTP 600 Series bridge installation with E1 or T1 requires all of the standard installation components (Table 4-1), with the following additions:

- Extra outdoor drop cable is required for the E1 or T1 link.
- Extra cables and connectors are required for the E1 or T1 drop cable.
- Four Lightning Protection Unit (LPU) double end kits (Motorola part number WB2907C) are required rather than two.
- Extra cable grounding kits for 1/4” and 3/8” cable (Motorola part number 01010419001) are required for the E1 or T1 drop cable.

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ODU specifications

This section contains specifications of the outdoor unit (ODU) that is supplied by Motorola for PTP 600 installations. These specifications apply to all PTP 600 product variants.

Dimensions and weight

The PTP 600 integrated ODU conforms to the physical specifications listed in Table 4-5.

Table 4-5 Integrated ODU physical specifications

Category	Specification
Dimensions	Width 370 mm (14.5 in), Height 370 mm (14.5 in), Depth 95 mm (3.75 in)
Weight	5.5 Kg (12.1 lbs) including bracket

The PTP 600 connectorized ODU conforms to the physical specifications listed in Table 4-6.

Table 4-6 Connectorized ODU physical specifications

Category	Specification
Dimensions	Width 305 mm (12 in), Height 305 mm (12 in), Depth 105 mm (4.01 in)
Weight	4.3 Kg (9.1 lbs) including bracket

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Environmental

The PTP 600 ODU conforms to the environmental specifications listed in Table 4-10.

Table 4-7 ODU environmental specifications

Category	Specification
Temperature	-40°C (40°F) to +60°C (140°F)
Wind loading	150 mph (242 kph) maximum. See Wind loading on page 2-7 for a full description.
Humidity	100% condensing
Waterproof	IP65
UV exposure	10 year operational life (UL746C test evidence)

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PIDU Plus specifications

This section contains specifications of the powered indoor unit (PIDU Plus) that is supplied by Motorola for PTP 600 installations. These specifications apply to all PTP 600 product variants.

Dimensions and weight

The PTP 600 PIDU Plus conforms to the physical specifications listed in Table 4-8.

Table 4-8 PIDU Plus physical specifications

Category	Specification
Dimensions	Width 250 mm (9.75 in), Height 40 mm (1.5 in), Depth 80 mm (3 in)
Weight	0.864 Kg (1.9 lbs)

Environmental

The PTP 600 PIDU Plus conforms to the environmental specifications listed in Table 4-9.

Table 4-9 PIDU Plus environmental specifications

Category	Specification
Temperature	-40°C (40°F) to +60°C (140°F) Suitable for use indoors, or outdoors within a weatherproofed cabinet.
Humidity	0 to 95% non-condensing
Waterproof	Not waterproof

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Electrical

The PTP 600 PIDU Plus conforms to the electrical specifications listed in Table 4-10.

Table 4-10 PIDU Plus electrical specifications

Category	Specification
AC Input	90 – 264 V AC, 47 – 60 Hz
Alternative DC Input	36 – 60 V DC
DC Output Voltage	For mains input: 55 V, +2V, -0V For DC input: Output voltage at maximum rated output current, not more than 1.5 V below the DC input voltage
AC Input connector	IEC 320-C8, (figure of eight)
DC Output current	1.4A
Efficiency	Better than 84%
Over Current Protection	Hiccup current limiting, trip point set between 120% to 150% of full load current
Hold up time	At least 20 milliseconds

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Cable and connector specifications

This section contains specifications of the CAT5e cables, connectors and glands that are required for PTP 600 installations.

Outdoor CAT5e cable (drop cable)

⚠ CAUTION

Always use Cat5e cable that is gel-filled and shielded with copper-plated steel. Alternative types of drop cable are not supported by Motorola.

A suitable make of outdoor drop cable is Superior Essex BBDGe, with part numbers as specified in Table 4-11.

Table 4-11 Superior Essex cable - available lengths and part numbers

Length (on plywood reel)	Part number
304 m (1000 ft)	BBDGe 04-001-55
762 m (2500 ft)	BBDGe 04-002-55
1524 m (5000 ft)	BBDGe 04-003-55
Cut to length	BBDGe 04-601-55

Outdoor connectors and glands – ODU or LPU

The recommended connectors and glands to be used for connecting the supported drop cable to the ODU or LPU are specified in Table 4-12.

Table 4-12 Recommended outdoor connectors for ODU and LPU

Item	Manufacturer	Part number
Connector	Tyco (AMP)	5-569278
Crimp tool	Tyco (AMP)	2-231652
Die set	Tyco (AMP)	1-8534400-0
Gland	Motorola	WB1811

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NOTE

The connector, crimp tool and die set listed in Table 4-12 are specific to Superior Essex BBDGe cable. They may not work with other makes of cable.

Outdoor connectors and glands – Trimble GPS

The recommended connectors and glands to be used for connecting the supported drop cable to the Trimble GPS receiver are specified in Table 4-13.

Table 4-13 Recommended outdoor connectors for Trimble GPS receiver

Item	Manufacturer	Part number
12 way circular connector	Deutsch	IMC26-2212X
Size 22 crimp socket	Deutsch	6862-201-22278
Crimp tool	Daniels Manufacturing Corp	MH860
Positioner	Daniels Manufacturing Corp	86-5
Insertion / extraction tool	Deutsch	6757-201-2201
Adaptor	Deutsch	IMC2AD
Self amalgamating tape		

Indoor CAT5e cable

The CAT5e cable that connects the PIDU Plus to the network equipment should be purchased separately and must meet the following requirements:

- It must be either foil screen (FTP) or braided screen (STP) cable.
- It must use screened RJ45 connectors with metal shells at both ends.
- There must be a continuous electrical connection between both screened connectors.

CAUTION

The connected network equipment must feature screened RJ45 connectors and must be connected to ground, otherwise the PIDU Plus will not be grounded.

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Antenna specifications

This section contains specifications of the antennas that are approved by the FCC for use with the connectorized PTP 54600 and PTP 58600.

Antenna selection criteria

The main selection criterion is the required antenna gain. The secondary criterion is the ease of mounting and alignment. For example, the Radio Waves Parabolic dishes are supplied with a mount that allows adjustment for alignment independent of the actual antenna mounting. This type of antenna is much easier to align than those that have to be rotated around the mounting pole for alignment.

Non-FCC regions

In non-FCC regions, antenna choice is not restricted, but any region specific EIRP limit must be obeyed by reducing the maximum Transmit power, see Licenses and region codes on page 4-36.

FCC regions

In FCC regions, antenna choice is restricted as described in PTP 54600 FCC antenna restrictions on page 4-18 and PTP 58600 FCC antenna restrictions on page 4-21.

The maximum permitted antenna gain depends upon product variant and channel bandwidth, as specified in Regulatory issues with connectorized units on page 4-94.

PTP 54600 FCC antenna restrictions

In FCC regions, external antennas from the list in Table 4-14 can be used with the Connectorized version of the PTP 54600. These are approved by the FCC for use with the product and are constrained by the following limit for Single/Dual Polarization Parabolic Dish Antennas: up to 34.9 dBi (33.4 dBi for 5 MHz bandwidth) per polarization or antenna.

However, the Maximum Transmit Power must be reduced to avoid exceeding the EIRP limits.

In FCC regions when using external antennas, cable loss between the connectorized version of the PTP 600 Series and the antenna ports must not be less than 1.2 dB.

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⚠ CAUTION

Antennas not included in this table, or those having a gain greater than the specified maximum, are strictly prohibited for use with the PTP 54600. The required antenna impedance is 50 ohms.

Table 4-14 Allowed antennas for deployment in USA/Canada – 5.4 GHz

Manufacturer	Antenna Type	Gain (dBi)	Parabolic Dish
Andrew	Andrew 2-foot Parabolic, P2F-52 (29.4dBi)	29.4	Y
Andrew	Andrew 2-foot Dual-Pol Parabolic, PX2F-52 (29.4dBi)	29.4	Y
Andrew	Andrew 3-foot Parabolic, P3F-52 (33.4dBi)	33.4	Y
Andrew	Andrew 3-foot Dual-Pol Parabolic, PX3F-52 (33.4dBi)	33.4	Y
Andrew	Andrew 4-foot Parabolic, P4F-52 (34.9dBi)	34.9	Y
Andrew	Andrew 4-foot Dual-Pol Parabolic, PX4F-52 (34.9dBi)	34.9	Y
Gabriel	Gabriel 2-foot High Performance QuickFire Parabolic, HQF2-52-N	28.2	Y
Gabriel	Gabriel 4-foot High Performance QuickFire Parabolic, HQF4-52-N	34.4	Y
Gabriel	Gabriel 2-foot High Performance Dual QuickFire Parabolic, HQFD2-52-N	28.1	Y
Gabriel	Gabriel 4-foot High Performance Dual QuickFire Parabolic, HQFD4-52-N	34.3	Y
Gabriel	Gabriel 2-foot Standard QuickFire Parabolic, QF2-52-N	28.5	Y
Gabriel	Gabriel 2-foot Standard QuickFire Parabolic, QF2-52-N-RK	28.5	Y
Gabriel	Gabriel 2.5-foot Standard QuickFire Parabolic, QF2.5-52-N	31.2	Y
Gabriel	Gabriel 4-foot Standard QuickFire Parabolic, QF4-52-N	34.8	Y

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Manufacturer	Antenna Type	Gain (dBi)	Parabolic Dish
Gabriel	Gabriel 4-foot Standard QuickFire Parabolic, QF4-52-N-RK	34.8	Y
Gabriel	Gabriel 2-foot Standard Dual QuickFire Parabolic, QFD2-52-N	28.4	Y
Gabriel	Gabriel 2.5-foot Standard Dual QuickFire Parabolic, QFD2.5-52-N	31.1	Y
Gabriel	Gabriel 2-foot Standard Dual QuickFire Parabolic, QFD2-52-N-RK	28.4	Y
Gabriel	Gabriel 4-foot Standard Dual QuickFire Parabolic, QFD4-52-N	34.7	Y
Gabriel	Gabriel 4-foot Standard Dual QuickFire Parabolic, QFD4-52-N-RK	34.7	Y
RadioWaves	Radio Waves 2-foot Dual-Pol Parabolic, SPD2-5.2 (28.1dBi)	28.1	Y
RadioWaves	Radio Waves 2-foot Parabolic, SP2-5.2 (29.0dBi)	29	Y
RadioWaves	Radio Waves 3-foot Dual-Pol Parabolic, SPD3-5.2 (31.1dBi)	31.1	Y
RadioWaves	Radio Waves 3-foot Parabolic, SP3-5.2 (31.4dBi)	31.4	Y
RadioWaves	Radio Waves 4-foot Dual-Pol Parabolic, SPD4-5.2 (34.4dBi)	34.4	Y
RadioWaves	Radio Waves 4-foot Parabolic, SP4-5.2 (34.8dBi)	34.8	Y
RadioWaves	Radio Waves 2-foot Parabolic, SP2-2/5 (28.3dBi)	28.3	Y
RadioWaves	Radio Waves 3-foot Parabolic, SP3-2/5 (31.4dBi)	31.4	Y
RadioWaves	Radio Waves 4-foot Parabolic, SP4-2/5 (34.6dBi)	34.6	Y
RFS	RFS 2-foot Parabolic, SPF2-52AN or SPFX2-52AN (27.9dBi)	27.9	Y

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Manufacturer	Antenna Type	Gain (dBi)	Parabolic Dish
RFS	RFS 3-foot Parabolic, SPF3-52AN or SPFX3-52AN(31.4dBi)	31.4	Y
RFS	RFS 4-foot Parabolic, SPF4-52AN or SPFX4-52AN(33.9dBi)	33.9	Y
RFS	RFS 2-foot HP Parabolic, SDF2-52AN or SDFX2-52AN (31.4dBi)	31.4	Y
RFS	RFS 4-foot HP Parabolic, SDF4-52AN or SDFX4-52AN (33.9dBi)	33.9	Y

PTP 58600 FCC antenna restrictions

In FCC regions, external antennas from the lists in Table 4-15 and Table 4-16 can be used with the Connectorized version of the PTP 58600. These are approved by the FCC for use with the product and are constrained by the following limit for Single/Dual Polarization Parabolic Dish Antennas: up to 37.7 dBi per polarization or antenna.

In FCC regions when using external antennas, cable loss between the connectorized version of the PTP 600 Series and the antenna ports must not be less than 1.2 dB.

⚠ CAUTION

Antennas not included in this table, or those having a gain greater than the specified maximum, are strictly prohibited for use with the PTP 58600. The required antenna impedance is 50 ohms.

Table 4-15 Allowed antennas for deployment in USA/Canada – 5.8 GHz

Manufacturer	Antenna Type	Gain (dBi)	Flat Plate	Parabolic Dish
Andrew	Andrew 1-foot Flat Panel, FPA5250D12-N (23.6dBi)	23.6	Y	
Andrew	Andrew 2-foot Flat Panel, FPA5250D24-N (28dBi)	28	Y	
Gabriel	Gabriel 1-foot Flat Panel, DFPD1-52 (23.5dBi)	23.5	Y	

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Manufacturer	Antenna Type	Gain (dBi)	Flat Plate	Parabolic Dish
Gabriel	Gabriel 2-foot Flat Panel, DFPD2-52 (28dBi)	28	Y	
MTI	MTI 17 inch Diamond Flat Panel, MT-485009 (23dBi)	23	Y	
MTI	MTI 15 inch Dual-Pol Flat Panel, MT-485025/NVH (23dBi)	23	Y	
MTI	MTI 2 ft Directional Flat Panel, MT-20004 (28dBi)	28	Y	
MTI	MTI 2 ft Flat Panel, MT-486001 (28dBi)	28	Y	
RFS	RFS 1-foot Flat Panel, MA0528-23AN (23dBi)	23	Y	
RFS	RFS 2-foot Flat Panel, MA0528-28AN (28dBi)	28	Y	
Telectronics	Teletronics 2-foot Flat Plate Antenna, ANT-P5828 (28dBi)	28	Y	
Andrew	Andrew 2-foot Parabolic, P2F-52 (29.4dBi)	29.4		Y
Andrew	Andrew 2-foot Dual-Pol Parabolic, PX2F-52 (29.4dBi)	29.4		Y
Andrew	Andrew 3-foot Parabolic, P3F-52 (33.4dBi)	33.4		Y
Andrew	Andrew 3-foot Dual-Pol Parabolic, PX3F-52 (33.4dBi)	33.4		Y
Andrew	Andrew 4-foot Parabolic, P4F-52 (34.9dBi)	34.9		Y
Andrew	Andrew 4-foot Dual-Pol Parabolic, PX4F-52 (34.9dBi)	34.9		Y
Andrew	Andrew 6-foot Parabolic, P6F-52 (37.6dBi)	37.6		Y
Andrew	Andrew 6-foot Dual-Pol Parabolic, PX6F-52 (37.6dBi)	37.6		Y

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Manufacturer	Antenna Type	Gain (dBi)	Flat Plate	Parabolic Dish
Gabriel	Gabriel 2-foot High Performance QuickFire Parabolic, HQF2-52-N	28.2		Y
Gabriel	Gabriel 4-foot High Performance QuickFire Parabolic, HQF4-52-N	34.4		Y
Gabriel	Gabriel 6-foot High Performance QuickFire Parabolic, HQF6-52-N	37.4		Y
Gabriel	Gabriel 2-foot High Performance Dual QuickFire Parabolic, HQFD2-52-N	28.1		Y
Gabriel	Gabriel 4-foot High Performance Dual QuickFire Parabolic, HQFD4-52-N	34.3		Y
Gabriel	Gabriel 6-foot High Performance Dual QuickFire Parabolic, HQFD6-52-N	37.3		Y
Gabriel	Gabriel 2-foot Standard QuickFire Parabolic, QF2-52-N	28.5		Y
Gabriel	Gabriel 2-foot Standard QuickFire Parabolic, QF2-52-N-RK	28.5		Y
Gabriel	Gabriel 2.5-foot Standard QuickFire Parabolic, QF2.5-52-N	31.2		Y
Gabriel	Gabriel 4-foot Standard QuickFire Parabolic, QF4-52-N	34.8		Y
Gabriel	Gabriel 4-foot Standard QuickFire Parabolic, QF4-52-N-RK	34.8		Y
Gabriel	Gabriel 6-foot Standard QuickFire Parabolic, QF6-52-N	37.7		Y
Gabriel	Gabriel 2-foot Standard Dual QuickFire Parabolic, QFD2-52-N	28.4		Y
Gabriel	Gabriel 2.5-foot Standard Dual QuickFire Parabolic, QFD2.5-52-N	31.1		Y

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Manufacturer	Antenna Type	Gain (dBi)	Flat Plate	Parabolic Dish
Gabriel	Gabriel 2-foot Standard Dual QuickFire Parabolic, QFD2-52-N-RK	28.4		Y
Gabriel	Gabriel 4-foot Standard Dual QuickFire Parabolic, QFD4-52-N	34.7		Y
Gabriel	Gabriel 4-foot Standard Dual QuickFire Parabolic, QFD4-52-N-RK	34.7		Y
Gabriel	Gabriel 6-foot Standard Dual QuickFire Parabolic, QFD6-52-N	37.7		Y
RadioWaves	Radio Waves 2-foot Dual-Pol Parabolic, SPD2-5.2 (28.1dBi)	28.1		Y
RadioWaves	Radio Waves 2-foot Parabolic, SP2-5.2 (29.0dBi)	29		Y
RadioWaves	Radio Waves 3-foot Dual-Pol Parabolic, SPD3-5.2 (31.1dBi)	31.1		Y
RadioWaves	Radio Waves 3-foot Parabolic, SP3-5.2 (31.4dBi)	31.4		Y
RadioWaves	Radio Waves 4-foot Dual-Pol Parabolic, SPD4-5.2 (34.4dBi)	34.4		Y
RadioWaves	Radio Waves 4-foot Parabolic, SP4-5.2 (34.8dBi)	34.8		Y
RadioWaves	Radio Waves 6-foot Dual-Pol Parabolic, SPD6-5.2 (37.5dBi)	37.5		Y
RadioWaves	Radio Waves 6-foot Parabolic, SP6-5.2 (37.7dBi)	37.7		Y
RadioWaves	Radio Waves 2-foot Parabolic, SP2-2/5 (28.3dBi)	28.3		Y
RadioWaves	Radio Waves 3-foot Parabolic, SP3-2/5 (31.4dBi)	31.4		Y
RadioWaves	Radio Waves 4-foot Parabolic, SP4-2/5 (34.6dBi)	34.6		Y
RadioWaves	Radio Waves 6-foot Parabolic, SP6-2/5 (37.7dBi)	37.7		Y

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Manufacturer	Antenna Type	Gain (dBi)	Flat Plate	Parabolic Dish
RFS	RFS 2-foot Parabolic, SPF2-52AN or SPFX2-52AN (27.9dBi)	27.9		Y
RFS	RFS 3-foot Parabolic, SPF3-52AN or SPFX3-52AN(31.4dBi)	31.4		Y
RFS	RFS 4-foot Parabolic, SPF4-52AN or SPFX4-52AN(33.9dBi)	33.9		Y
RFS	RFS 6-foot Parabolic, SPF6-52AN or SPFX6-52AN (37.4dBi)	37.4		Y
RFS	RFS 2-foot HP Parabolic, SDF2-52AN or SDFX2-52AN (31.4dBi)	31.4		Y
RFS	RFS 4-foot HP Parabolic, SDF4-52AN or SDFX4-52AN (33.9dBi)	33.9		Y
RFS	RFS 6-foot HP Parabolic, SDF6-52AN or SDFX6-52AN (37.4dBi)	37.4		Y
StellaDoradus	StellaDoradus 45 inch Parabolic Antenna, 58PSD113	33.8		Y

Table 4-16 Sectored antennas for deployment in USA/Canada – 5.8 GHz

Manufacturer	Antenna Type	Gain (dBi)	Beamwidth
RadioWaves	SEC-55V-60-17	17	60°
	SEC-55H-60-17		
	SEC-55D-60-17		
RadioWaves	SEC-55V-90-16	16	90°
	SEC-55H-90-16		
	SEC-55D-90-16		

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PTP-SYNC specifications

This section contains specifications of the PTP-SYNC unit that is supplied by Motorola for PTP 600 installations that require TDD synchronization via PTP-SYNC (optional).

Dimensions and weight

The PTP-SYNC unit conforms to the physical specifications listed in Table 4-17.

Table 4-17 PTP-SYNC unit physical specifications

Category	Specification
Dimensions	Width excluding ears 174 mm (6.69 in) Width including ears 196 mm (7.54 in) Height 31.5 mm (1.21 in) Depth 79 mm (3.04 in)
Weight	0.485 Kg (1.1 lbs)
Power supply	Integrated with PIDU Plus
Power source	+39 V dc to +60 V dc
Power consumption	1.5 W max (extra power is required to supply a GPS receiver)

Environmental

The PTP-SYNC unit conforms to the environmental specifications listed in Table 4-18.

Table 4-18 PTP-SYNC unit environmental specifications

Category	Specification
Temperature	-40°C (40°F) to +60°C (140°F) Suitable for use indoors, or outdoors within a weatherproofed cabinet.
Humidity	0 to 95% non-condensing
Waterproof	Not waterproof

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Electrical

The PTP-SYNC unit conforms to the electrical specifications listed in Table 4-19.

Table 4-19 PTP-SYNC unit electrical specifications

Category	Specification
Power source	90 – 264 V AC, 50 – 60 Hz, or 36 – 60 V DC
Power consumption	55 W max

Timing inputs

There are two timing inputs to the PTP-SYNC unit: GPS/SYNC IN (RJ-45) (Table 4-20) and 1PPS IN (SMA) (Table 4-21).

Table 4-20 PTP-SYNC unit timing specifications - GPS/SYNC IN (RJ-45)

Category	Specification
Signal type	Differential 1 Hz signal
Common mode range	–7 V to +7 V, relative to GPS/SYNC IN pin 2
Maximum differential voltage	±5 V
Threshold	±0.4 V
Impedance	90 ohms to 110 ohms
Pulse width	1 μs to 500 ms
Polarity	Reference edge is when pin 3 (PPSA) is positive with respect to pin 6 (PPSB)

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Table 4-21 PTP-SYNC unit timing specifications - 1PPS IN (SMA)

Category	Specification
Signal type	1 Hz signal
Pulse	Positive pulse, reference edge is rising edge
Maximum voltage	5 V
Threshold	0.4 V to 0.6 V
Input impedance	45 ohms to 55 ohms
Pulse width	1μs to 500ms

GPS/SYNC IN pinout description

The pinouts of the PTP-SYNC unit GPS/SYNC IN port are specified in Table 4-22.

Table 4-22 GPS/SYNC IN port pinouts

Pin no.	Connector pinout signal name	Signal description
Pin 1	12VGPS	12 V output to GPS receiver module, 250 mA max
Pin 2	GND	Ground
Pin 3	GPS_1PPSA	1 Hz pulse input
Pin 4	GPS_RXDA	GPS receive data
Pin 5	GPS_RXDB	GPS receive data
Pin 6	GPS_1PPSB	1 Hz pulse input
Pin 7	GPS_TXDA	GPS transmit data
Pin 8	GPS_TXDB	GPS transmit data

NOTE

The GPS_1PPS, GPS_RXD and GPS_TXD signals conform to International Telecommunication Union (ITU) recommendation V.11 (RS422).

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Wireless specifications

General wireless specifications

Table 4-23 PTP 25600 RF specifications

Radio Technology	Specification
RF Band	Lower: 2.496-2.568 GHz Middle: 2.572-2.614 GHz Upper: 2.618-2.690 GHz
Channel Selection	Manual selection.
Dynamic Frequency Control	N/A
Channel size	5, 10, 15 and 30 MHz
Manual Power Control	Maximum power can be controlled lower than the power limits shown above in order to control interference to other users of the band.
Receiver Noise Figure	Typically 5 dB
Antenna Type	Integrated flat plate antenna
Antenna Gain	18 dBi typical
Antenna Beamwidth	18 Degrees
Max Path Loss	157 dB (5 MHz channel)
Duplex Scheme	Symmetric fixed, asymmetric fixed or adaptive TDD
Range	125 miles (200km) optical Line-of-Sight 6 miles (10km) non-Line-of-Sight
Over-the-Air Encryption	Proprietary scrambling mechanism.
Weather Sensitivity	Sensitivity at higher modes may be reduced during high winds through trees due to Adaptive Modulation Threshold changes.
Error Correction	FEC

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Table 4-24 PTP 45600 RF specifications

Radio Technology	Specification
RF Band	4.400-4.600 GHz
Channel Selection	Manual selection.
Dynamic Frequency Control	By intelligent Dynamic Frequency Selection (i-DFS) or manual intervention; automatic selection on start-up and continual adaptation to avoid interference.
Channel size	5, 10, 15, 20 and 30 MHz
Manual Power Control	Maximum power can be controlled lower than the power limits shown above in order to control interference to other users of the band.
Receiver Noise Figure	Typically 5 dB
Antenna Type	Integrated flat plate antenna
Antenna Gain	21.5 dBi typical
Antenna Beamwidth	11 Degrees
Max Path Loss	157 dB (5 MHz channel)
Duplex Scheme	Symmetric fixed, asymmetric fixed or adaptive TDD
Range	125 miles (200km) optical Line-of-Sight 6 miles (10km) non-Line-of-Sight
Over-the-Air Encryption	Proprietary scrambling mechanism.
Weather Sensitivity	Sensitivity at higher modes may be reduced during high winds through trees due to Adaptive Modulation Threshold changes
Error Correction	FEC

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Table 4-25 PTP 48600 RF specifications

Radio Technology	Specification
RF Band	4.710-5.000 GHz
Channel Selection	Manual selection.
Dynamic Frequency Control	By intelligent Dynamic Frequency Selection (i-DFS) or manual intervention; automatic selection on start-up and continual adaptation to avoid interference.
Channel size	5, 10, 15, and 20 MHz
Manual Power Control	Maximum power can be controlled lower than the power limits shown above in order to control interference to other users of the band.
Receiver Noise Figure	Typically 5 dB
Antenna Type	Integrated flat plate antenna
Antenna Gain	22 dBi typical
Antenna Beamwidth	11 Degrees
Max Path Loss	157 dB (5 MHz channel)
Duplex Scheme	Symmetric fixed, asymmetric fixed or adaptive TDD
Range	125 miles (200km) optical Line-of-Sight 6 miles (10km) non-Line-of-Sight
Over-the-Air Encryption	Proprietary scrambling mechanism.
Weather Sensitivity	Sensitivity at higher modes may be reduced during high winds through trees due to Adaptive Modulation Threshold changes
Error Correction	FEC

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Table 4-26 PTP 49600 RF specifications

Radio Technology	Specification
RF Band	4.900-4.990 GHz
Channel Selection	Manual selection.
Dynamic Frequency Control	By intelligent Dynamic Frequency Selection (i-DFS) or manual intervention; automatic selection on start-up and continual adaptation to avoid interference.
Channel size	5, 10 and 20 MHz
Manual Power Control	Maximum power can be controlled lower than the power limits shown above in order to control interference to other users of the band.
Receiver Noise Figure	Typically 5 dB
Antenna Type	Integrated flat plate antenna
Antenna Gain	Typical: 22 dBi Maximum permitted: 26 dBi
Antenna Beamwidth	11 Degrees
Max Path Loss	157 dB (5 MHz channel)
Duplex Scheme	Symmetric fixed, asymmetric fixed or adaptive TDD
Range	125 miles (200km) optical Line-of-Sight 6 miles (10km) non-Line-of-Sight
Over-the-Air Encryption	Proprietary scrambling mechanism.
Weather Sensitivity	Sensitivity at higher modes may be reduced during high winds through trees due to Adaptive Modulation Threshold changes
Error Correction	FEC

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Table 4-27 PTP 54600 RF specifications

Radio Technology	Specification
RF Band	5.470-5.725 GHz
Channel Selection	By dynamic frequency control and manual intervention Automatic detection on start-up and continual adaptation to avoid interference.
Dynamic Frequency Control	Initial capture 10-15 sec. Out of service on interference 100 ms.
Channel size	5, 10, 15 and 30 MHz
Manual Power Control	Maximum power can be controlled lower than the power limits shown above in order to control interference to other users of the band.
Receiver Noise Figure	Typically 6 dB
Integrated Antenna Type/Gain	Integrated flat plate antenna; 23dBi
External Antenna Gain	Depends on feeder losses, see Regulatory issues with connectorized units on page 4-94.
Antenna Beamwidth	8 Degrees
Max Path Loss	169 dB (5 MHz channel, integrated antenna)
Duplex Scheme	Symmetric fixed, asymmetric fixed or adaptive TDD
Range	125 miles (200km) optical Line-of-Sight 6 miles (10km) non-Line-of-Sight
Over-the-Air Encryption	Proprietary scrambling mechanism.
Weather Sensitivity	Sensitivity at higher modes may be reduced during high winds through trees due to Adaptive Modulation Threshold changes
Error Correction	FEC

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Table 4-28 PTP 58600 RF specifications

Radio Technology	Specification
RF Band	5.725-5.850 GHz
Channel Selection	By dynamic frequency control and manual intervention Automatic detection on start-up and continual adaptation to avoid interference.
Dynamic Frequency Control	Initial capture 10-15 sec. Out of service on interference 100 ms.
Channel size	5, 10, 15 and 30 MHz
Manual Power Control	Maximum power can be controlled lower than the power limits shown above in order to control interference to other users of the band.
Receiver Noise Figure	Typically 6 dB
Antenna Type (Integrated)	Flat plate antenna; 23 dBi
Antenna Type (External)	Parabolic dish, maximum permitted gain: 37.7 dBi Flat plate; maximum permitted gain: 28.0 dBi
Antenna Beamwidth (Integrated)	8 degrees
Max Path Loss	166 dB (5 MHz Channel)
Duplex Scheme	Symmetric fixed, asymmetric fixed or adaptive TDD
Range	125 miles (200km) optical line-of-sight 6 miles (10km) non-line-of-sight
Over-the-Air Encryption	Proprietary scrambling mechanism.
Weather Sensitivity	Sensitivity at higher modes may be reduced during high winds through trees due to Adaptive Modulation Threshold changes
Error Correction	FEC

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Table 4-29 PTP 59600 RF specifications

Radio Technology	Specification
RF Band	5.825-5.925GHz
Channel Selection	By dynamic frequency control and manual intervention Automatic detection on start-up and continual adaptation to avoid interference.
Dynamic Frequency Control	Initial capture 10-15 sec. Out of service on interference 100 ms.
Channel size	5, 10, 15 and 30 MHz
Manual Power Control	Maximum power can be controlled lower than the power limits shown above in order to control interference to other users of the band.
Receiver Noise Figure	Typically 6 dB
Antenna Type	Integrated flat plate antenna
Antenna Gain	23 dBi typical
Antenna Beamwidth	8 Degrees
Max Path Loss	166 dB (5 MHz Channel)
Duplex Scheme	Symmetric fixed, asymmetric fixed or adaptive TDD
Range	125 miles (200km) optical line-of-sight 6 miles (10km) non-line-of-sight
Over-the-Air Encryption	Proprietary scrambling mechanism.
Weather Sensitivity	Sensitivity at higher modes may be reduced during high winds through trees due to Adaptive Modulation Threshold changes
Error Correction	FEC

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Licenses and region codes

This section specifies the licenses and region codes that are available for each frequency variant.

When shipped, PTP 600 units are configured with a license key for a default region code, as indicated by (*1) in the following tables. For most frequency variants, an alternative license key is provided in the *PTP 600 Installation Guide* for one or more other region codes, as indicated by (*2) in the following tables. If the link is to be installed in any other permitted region, the user must obtain a new license key from the reseller or distributor.

Table 4-30 PTP 25600 licenses and region codes

Region Code	License / Regulation	Frequencies	DFS	Channel Bandwidth	Max Power
16 (*1)	FCC Upper	2624 - 2690 MHz		5, 10, 15, 30 MHz	63 dBm EIRP
	FCC Middle	2572 - 2614 MHz		5, 10, 15, 30 MHz	63 dBm EIRP
	FCC Lower	2496 - 2568 MHz		5, 10, 15, 30 MHz	63 dBm EIRP
18 (*2)	Taiwan Upper	2660 - 2690 MHz		5, 10, 15 MHz	23 dBm
	Taiwan Middle	2595 - 2625 MHz		5, 10, 15 MHz	23 dBm
	Taiwan Lower	2565 - 2595 MHz		5, 10, 15 MHz	23 dBm

(*1) License key region when shipped. (*2) Alternative license key region.

NOTE

For a PTP 25600 in region code 16, the EIRP limit is approximately 63 dBm + 10 x Log(360/Antenna Azimuth BW). PTP25600 products are not able to exceed this EIRP limit with any available antenna.

For PTP 25600, the 30MHz bandwidth is not approved in FCC regions.

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Table 4-31 PTP 45600 licenses and region codes

Region Code	License / Regulation	Frequencies	DFS	Channel Bandwidth	Max Power
23 (*1)	US Federal	4400 - 4600 MHz		5, 10, 15, 20, 30 MHz	27 dBm
24	NTIA	4400 - 4600 MHz		10, 20 MHz	27 dBm

(*1) License key region when shipped.

Table 4-32 PTP 48600 licenses and region codes

Region Code	License / Regulation	Frequencies	DFS	Channel Bandwidth	Max Power
14	USA/Canada Public Safety	4940 - 4990 MHz		5, 10, 20 MHz	24 dBm
15 (*1)	US Federal Extended	4710 - 5000 MHz		5, 10, 15, 20 MHz	27 dBm
23 (*2)	US Federal	4710 - 4940 MHz		5, 10, 15, 20 MHz	27 dBm
24	NTIA	4700 - 4940 MHz		10, 20 MHz	27 dBm

(*1) License key region when shipped. (*2) Alternative license key region.

NOTE

For PTP 48600 region code 14, Max Power depends upon Antenna Gain:

- If Antenna Gain < 26 dBi then Max Power = 24 dBm
- If Antenna Gain >= 26 dBi then Max Power = (50 – Antenna Gain) dBm

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Table 4-33 PTP 49600 licenses and region codes

Region code	License / Regulation	Frequencies	DFS	Channel Bandwidth	Max Power	Notes
14 (*1)	USA/Canada Public Safety	4940 - 4990 MHz		5, 10, 20 MHz	24 dBm	See note below.
18 (*2)	Hong Kong Public Safety	4900 - 4950 MHz		5, 10, 20 MHz	24 dBm	See note below.

(*1) License key region when shipped. (*2) Alternative license key region.

NOTE

For PTP 49600 region codes 14 and 18 Max Power depends upon Antenna Gain:

- If Antenna Gain < 26 dBi then Max Power = 24 dBm
- If Antenna Gain >= 26 dBi then Max Power = (50 – Antenna Gain) dBm

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Table 4-34 PTP 54600 licenses and region codes

Region code	License or Regulation	Frequencies	DFS	Channel Bandwidth	Max Power	Notes
7	Full Power + Radar	5470 - 5725 MHz	Yes	5, 10, 15, 30 MHz	25 dBm	
8	Full Power	5470 - 5725 MHz		5, 10, 15, 30 MHz	25 dBm	
12 (*2)	FCC	5470 - 5725 MHz	Yes	30 MHz	30 dBm EIRP	
				15 MHz	27 dBm EIRP	
				10 MHz	25 dBm EIRP	
				5 MHz	22 dBm EIRP	
13 (*2)	Australia, Canada	5470 - 5600 MHz 5650 - 5725 MHz	Yes	30 MHz	30 dBm EIRP	The band 5600 MHz to 5650 MHz is reserved for the use of weather radars.
				15 MHz	27 dBm EIRP	
				10 MHz	25 dBm EIRP	
				5 MHz	22 dBm EIRP	
20	Thailand	5470 - 5725 MHz		5, 10, 15, 30 MHz	30 dBm EIRP	
21	Korea	5470 - 5650 MHz		15 MHz	28 dBm EIRP	
				10 MHz	27 dBm EIRP	
				5 MHz	24 dBm EIRP	

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Region code	License or Regulation	Frequencies	DFS	Channel Bandwidth	Max Power	Notes
26 (*1)	ETSI	5470 - 5600 MHz 5650 - 5725 MHz	Yes	30 MHz	30 dBm EIRP	The band 5600 MHz to 5650 MHz is reserved for the use of weather radars.
				15 MHz	27 dBm EIRP	
				10 MHz	25 dBm EIRP	
				5 MHz	22 dBm EIRP	

(*1) License key region when shipped. (*2) Alternative license key region.

Table 4-35 PTP 58600 licenses and region codes

Region code	License / Regulation	Frequencies	DFS	Channel Bandwidth	Max Power	Notes
1 (*1)	FCC USA, Canada, Taiwan, Brazil	5725 - 5850 MHz		5, 10, 15, 30 MHz	25 dBm	Reduced TX power at band edges
2	China	5725 - 5850 MHz		30 MHz	33 dBm EIRP	
				15 MHz	31 dBm EIRP	
				10 MHz	30 dBm EIRP	
				5 MHz	27 dBm EIRP	
3	Australia, Hong Kong	5725 - 5850 MHz		5, 10, 15, 30 MHz	36 dBm EIRP	
4	UK	5725 - 5795 MHz 5815 - 5850 MHz	Yes	30 MHz	35 dBm EIRP	5795 MHz to 5815 MHz is assigned
				15 MHz	34 dBm EIRP	

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Region code	License / Regulation	Frequencies	DFS	Channel Bandwidth	Max Power	Notes
				10 MHz	32 dBm EIRP	for Road Transport and Traffic Telematics (RTTT).
				5 MHz	29 dBm EIRP	
5	Singapore	5725 - 5850 MHz		5, 10, 15, 30 MHz	20 dBm EIRP	
6	Eire	5725 - 5850 MHz		30 MHz	33 dBm EIRP	
				15 MHz	31 dBm EIRP	
				10 MHz	30 dBm EIRP	
				5 MHz	27 dBm EIRP	
7	Norway	5725 - 5795 MHz 5815 - 5850 MHz	Yes	30 MHz	53 dBm EIRP	5795 MHz to 5815 MHz is assigned for Road Transport and Traffic Telematics (RTTT).
				15 MHz	51 dBm EIRP	
				10 MHz	50 dBm EIRP	
				5 MHz	47 dBm EIRP	
8	Full Power	5725 - 5850 MHz		5, 10, 15, 30 MHz	25 dBm	
11	Korea	5725 - 5825 MHz		30 MHz	43 dBm EIRP	
				15 MHz	41 dBm EIRP	
				10 MHz	40 dBm EIRP	

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Region code	License / Regulation	Frequencies	DFS	Channel Bandwidth	Max Power	Notes
				5 MHz	37 dBm EIRP	
19	India	5825 - 5850 MHz		10, 15 MHz	36 dBm EIRP	
				5 MHz	33 dBm EIRP	
20	Thailand	5725 - 5850 MHz		5, 10, 15, 30 MHz	30 dBm EIRP	
22	Germany	5755 - 5850 MHz	Yes	30 MHz	35 dBm EIRP	1dB reduction required in 30 MHz to achieve adjacent channel emissions
				15 MHz	34 dBm EIRP	
				10 MHz	32 dBm EIRP	
				5 MHz	29 dBm EIRP	
24	Bahrain	5725 - 5850 MHz	Yes	30 MHz	33 dBm EIRP	
				15 MHz	31 dBm EIRP	
				10 MHz	30 dBm EIRP	
				5 MHz	27 dBm EIRP	
25 (*2)	ETSI	5725 - 5850 MHz	Yes	30 MHz	35 dBm EIRP	1dB reduction required in 30 MHz to achieve adjacent channel emissions
				15 MHz	34 dBm EIRP	
				10 MHz	32 dBm EIRP	
				5 MHz	29 dBm EIRP	

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Region code	License / Regulation	Frequencies	DFS	Channel Bandwidth	Max Power	Notes
27	Denmark	5725 - 5795 5815 - 5850 MHz	Yes	30 MHz	35 dBm EIRP	5795 MHz to 5815 MHz is assigned for Road Transport and Traffic Telematics (RTTT)
				15 MHz	34 dBm EIRP	
				10 MHz	32 dBm EIRP	
				5 MHz	29 dBm EIRP	

(*1) License key region when shipped. (*2) Alternative license key region.

NOTE

The 5.8 GHz license for India is addressed using both the PTP 58600 and PTP 59600 frequency variants.

Table 4-36 PTP 59600 licenses and region codes

Region code	License / Regulation	Frequencies	DFS	Channel Bandwidth	Max Power
15	Unrestricted	5825 - 5925 MHz		5, 10, 15, 30 MHz	25 dBm
16 (*1)	Russia	5825 - 5925 MHz		5, 10, 15, 30 MHz	25 dBm
17 (*2)	India	5875 - 5925 MHz		10, 15, 30 MHz	36 dBm EIRP
				5 MHz	33 dBm EIRP
19	India	5825 - 5875 MHz		10, 15, 30 MHz	36 dBm EIRP
				5 MHz	33 dBm EIRP

(*1) License key region when shipped. (*2) Alternative license key region.

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Available spectrum settings

PTP 25600 available spectrum settings

The supported 2.5GHz frequency range is split into three bands, according to the bands specified in the FCC BRS-EBS Post-Transition Band plan (only for PTP 25600 and region code 16):

- Lower: 2496 MHz to 2572 MHz with a 5.5MHz channel raster (76 MHz total).
- Middle: 2572 MHz to 2614 MHz with a 6 MHz channel raster (42 MHz total).
- Upper: 2618 MHz to 2690 MHz with a 5.5 MHz channel raster (76 MHz total).

NOTE

For the PTP 25600 product variant, the unit will only operate in Fixed Frequency mode, and the user is unable to select i-DFS.

The PTP 25600 product variant support channel centre frequencies as specified in Table 4-37. The 30MHz Channel Bandwidth is not supported in the FCC region.

Table 4-37 PTP 25600 channel plan - FCC BRS-EBS Post-Transition Band

Block	Channel Bandwidth (MHz)	Channel Centre Frequencies (MHz)
Lower Band Segment	5	2499.25, 2504.75, 2510.25, 2515.75, 2521.25, 2526.75, 2532.25, 2537.75, 2543.25, 2548.75, 2554.25, 2559.75, 2565.25
	10	2502, 2507.5, 2513, 2518.5, 2524, 2529.5, 2535, 2540.5, 2546, 2551.5, 2557, 2562.5
	15	2504.75, 2510.25, 2515.75, 2521.25, 2526.75, 2532.25, 2537.75, 2543.25, 2548.75, 2554.25, 2559.75
	30	2513, 2524, 2535, 2546
Middle Band Segment	5	2575, 2581, 2587, 2593, 2599, 2605, 2611
	10	2578, 2584, 2590, 2596, 2602, 2608
	15	2581, 2587, 2593, 2599, 2605
	30	2587, 2599
Upper Band	5	2626.75, 2632.25, 2637.75, 2643.25, 2648.75, 2654.25, 2659.75, 2665.25, 2670.75, 2676.25, 2681.75, 2687.25

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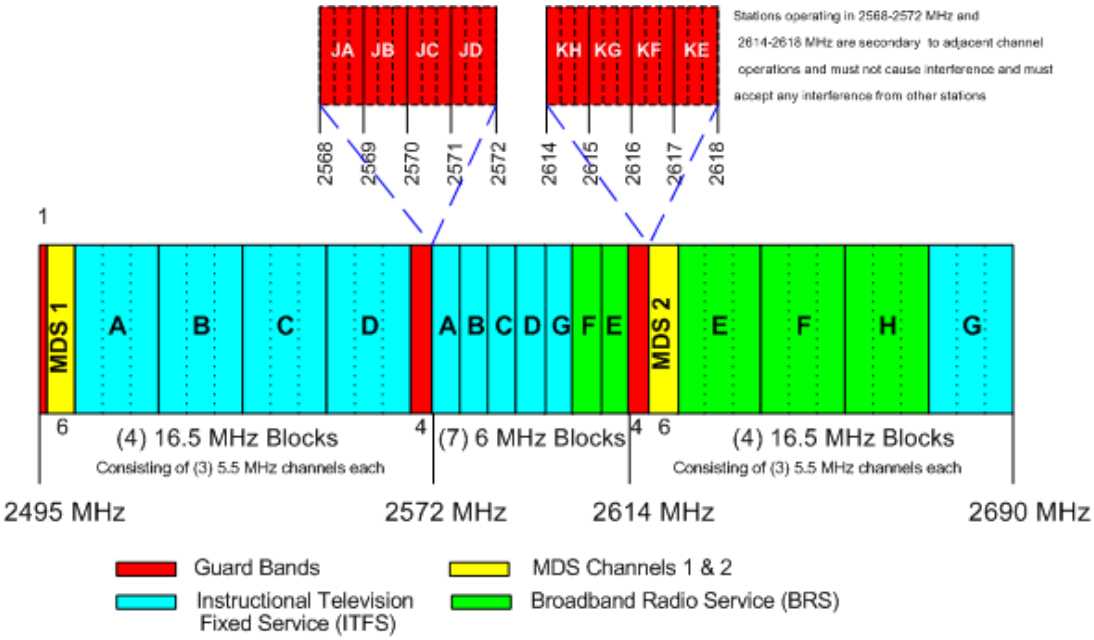
Block	Channel Bandwidth (MHz)	Channel Centre Frequencies (MHz)
Segment	10	2629.5, 2635, 2640.5, 2646, 2651.5, 2657, 2662.5, 2668, 2673.5, 2679, 2684.5
	15	2632.25, 2637.75, 2643.25, 2648.75, 2654.25, 2659.75, 2665.25, 2670.75, 2676.25, 2681.75
	30	2640.5, 2651.5, 2662.5, 2673.5

The channel centre frequencies listed above have been selected to align with the so-called post-transition BRS channels as shown in Figure 4-2.

The PTP 25600 frequency variant supports three portions of the BRS spectrum allocation. These are configurable at installation and constrain the wireless to operate in a limited portion of the Spectrum. The three frequency bands are as shown in Figure 4-2:

- **Band 1**: channels A, B, C and D (16.5 MHz blocks)
- **Band 2**: channels A through G (6 MHz blocks)
- **Band 3**: channels E, F, G and H (16.5 MHz blocks)

Figure 4-2 PTP 25600 BRS band channel assignments



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PTP 45600 available spectrum settings

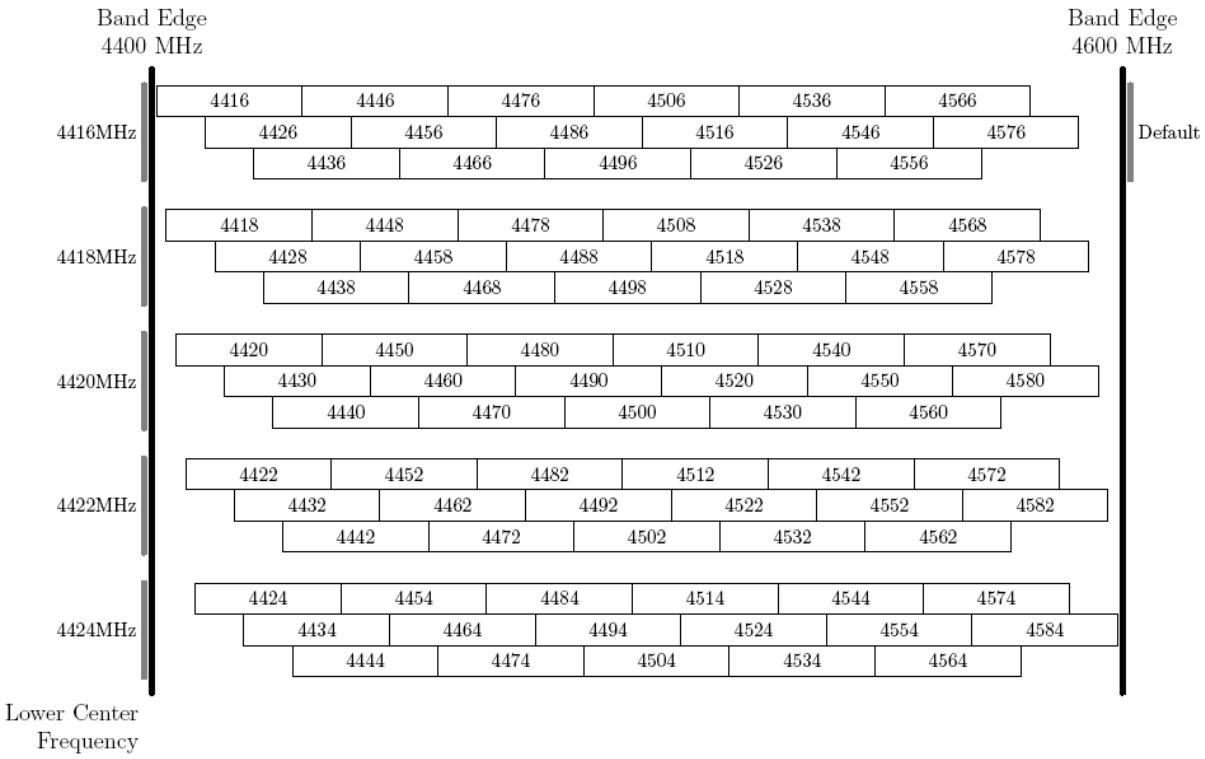
The PTP 45600 product variant does not apply any band edge power reduction.

Region code 23

Adjustment of the lower centre frequency allows the operator to slide the available frequency settings up and down the 4.5 GHz band in steps of 2 MHz.

In the 30 MHz (Figure 4-3) and 20 MHz (Figure 4-4) channel bandwidths, the PTP 45600 variant operates on a 10 MHz channel raster. In the 15 MHz (Figure 4-5), 10 MHz (Figure 4-6) and 5 MHz (Figure 4-7) channel bandwidths, the PTP 45600 variant operates on a 6 MHz channel raster. The channel raster is set to even centre frequencies.

Figure 4-3 PTP 45600 available spectrum in 30 MHz channel bandwidth (RC 23)



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Figure 4-4 PTP 45600 available spectrum in 20 MHz channel bandwidth (RC 23)

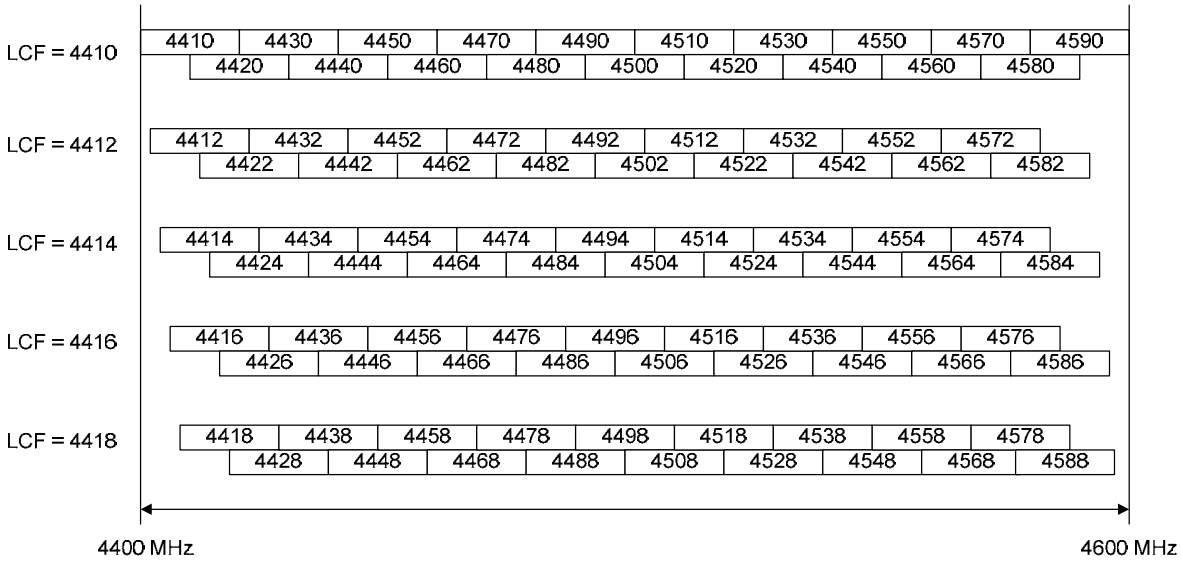
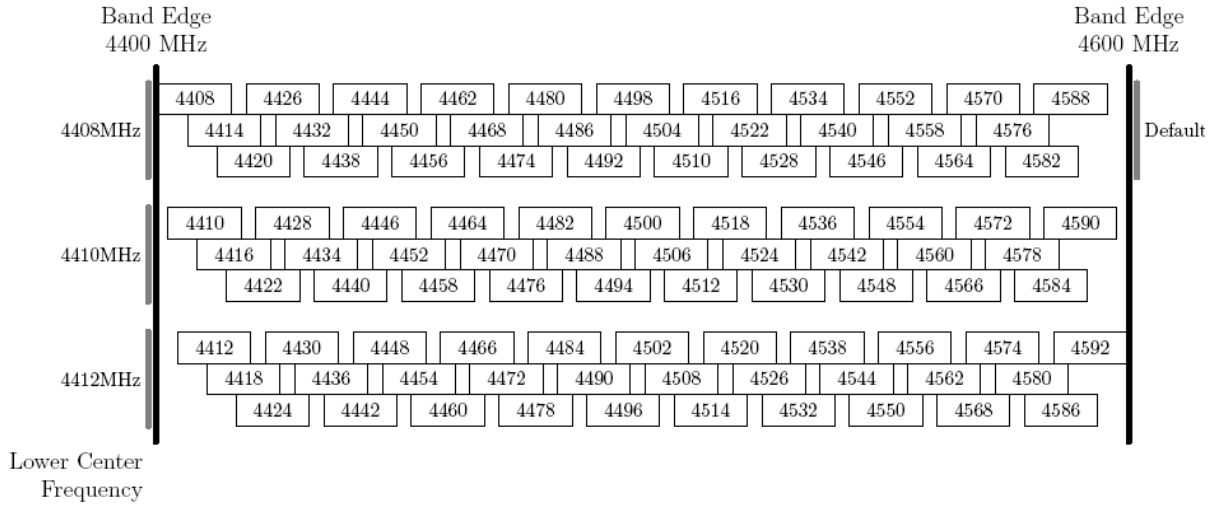


Figure 4-5 PTP 45600 available spectrum in 15 MHz channel bandwidth (RC 23)



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Figure 4-6 PTP 45600 available spectrum in 10 MHz channel bandwidth (RC 23)

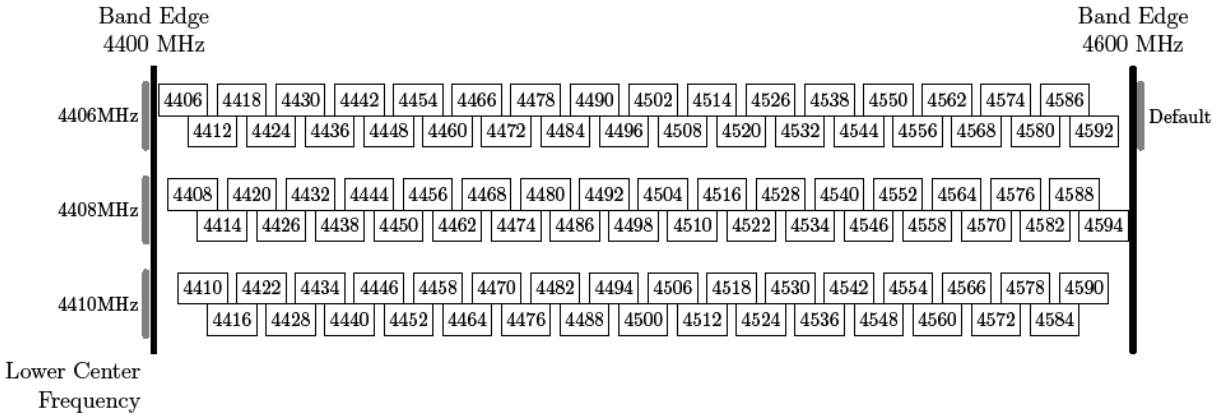
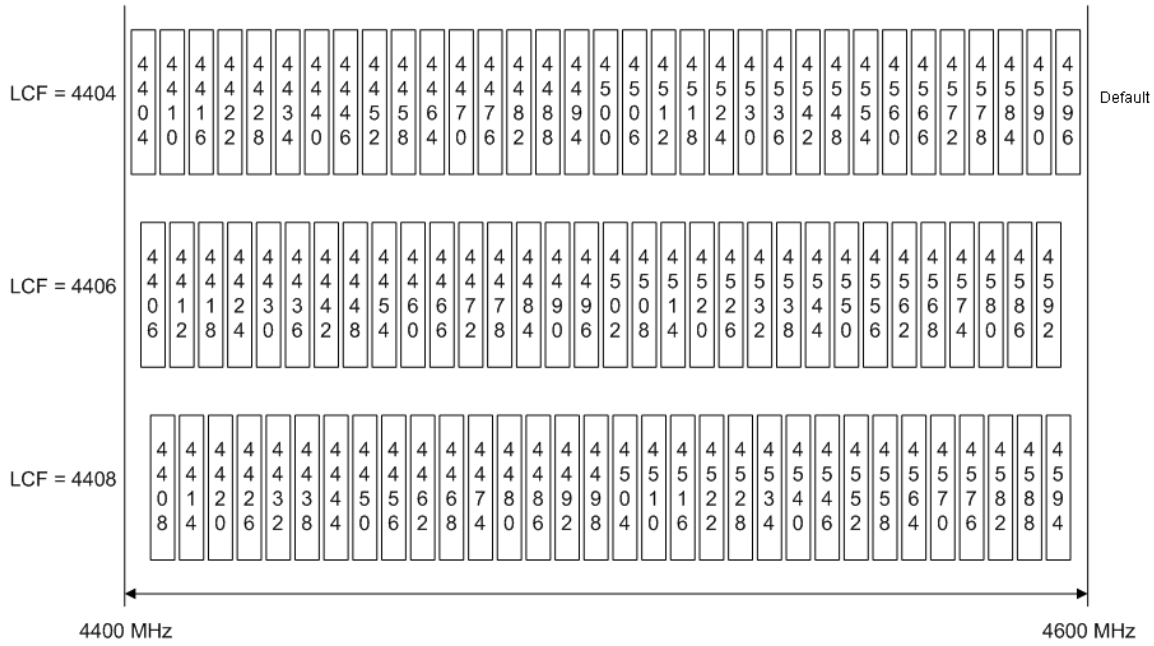


Figure 4-7 PTP 45600 available spectrum in 5 MHz channel bandwidth (RC 23)



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Region code 24 (NTIA)

In the 20 MHz (Figure 4-8) channel bandwidth, the PTP 45600 variant operates on a 20 MHz channel raster. In the 10 MHz (Figure 4-9) channel bandwidth, the PTP 45600 variant operates on a 10 MHz channel raster.

Figure 4-8 PTP 45600 available spectrum in 20 MHz channel bandwidth (RC 24)

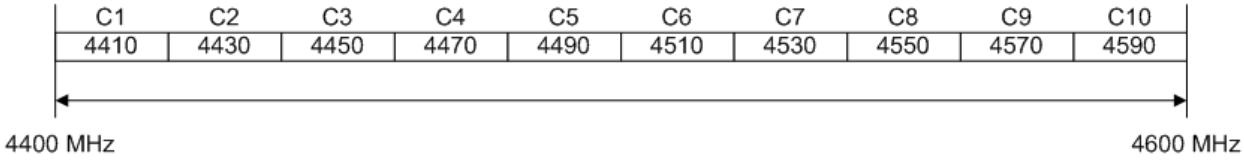
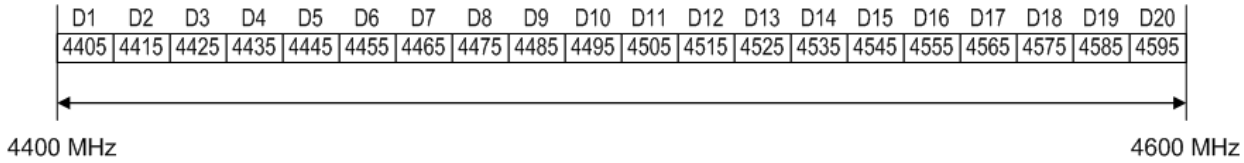


Figure 4-9 PTP 45600 available spectrum in 10 MHz channel bandwidth (RC 24)



PTP 48600 available spectrum settings

Region codes 15 and 23

Adjustment of the lower centre frequency allows the operator to slide the available frequency settings up and down the 4.8 GHz band in steps of 1 MHz.

In the 20 MHz (Figure 4-10) channel bandwidth, the PTP 48600 variant operates on a 10 MHz channel raster. In the 15 MHz (Figure 4-11), 10 MHz (Figure 4-12) and 5 MHz (Figure 4-13) channel bandwidths, the PTP 48600 variant operates on a 5 MHz channel raster. The default channel raster is set to even frequencies as that optimises radio performance.

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Figure 4-10 PTP 48600 available spectrum in 20 MHz channel bandwidth (RC 15 and 23)

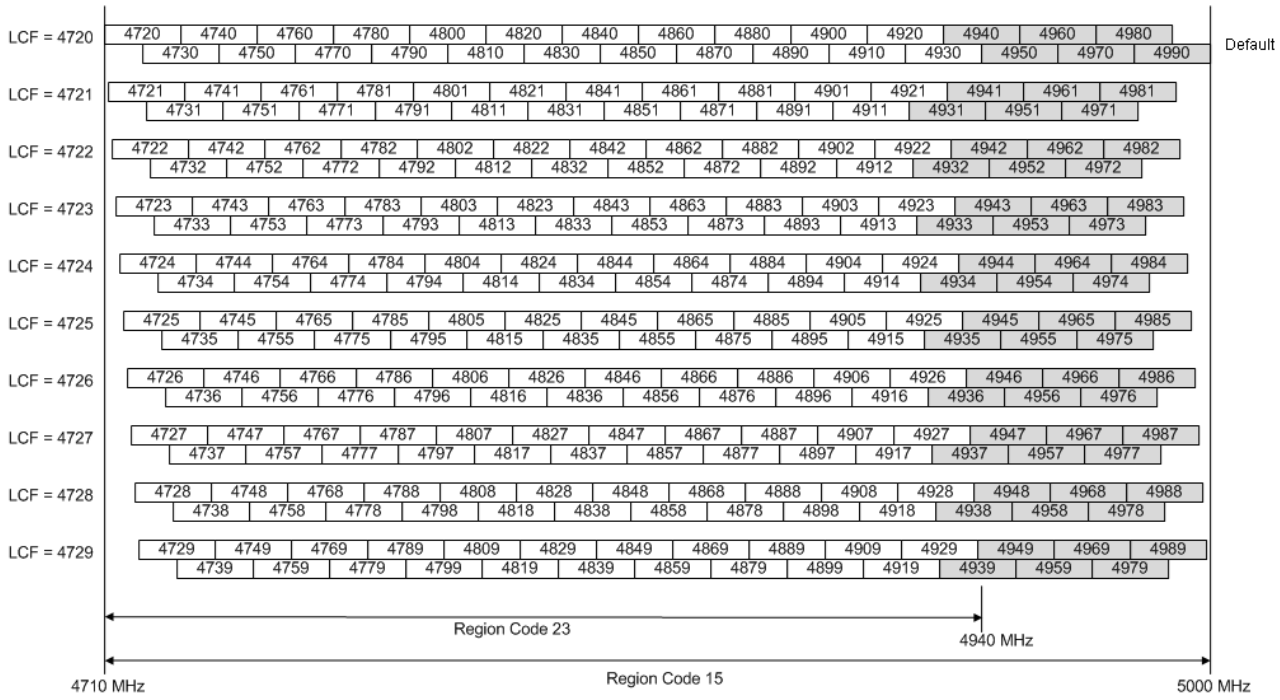
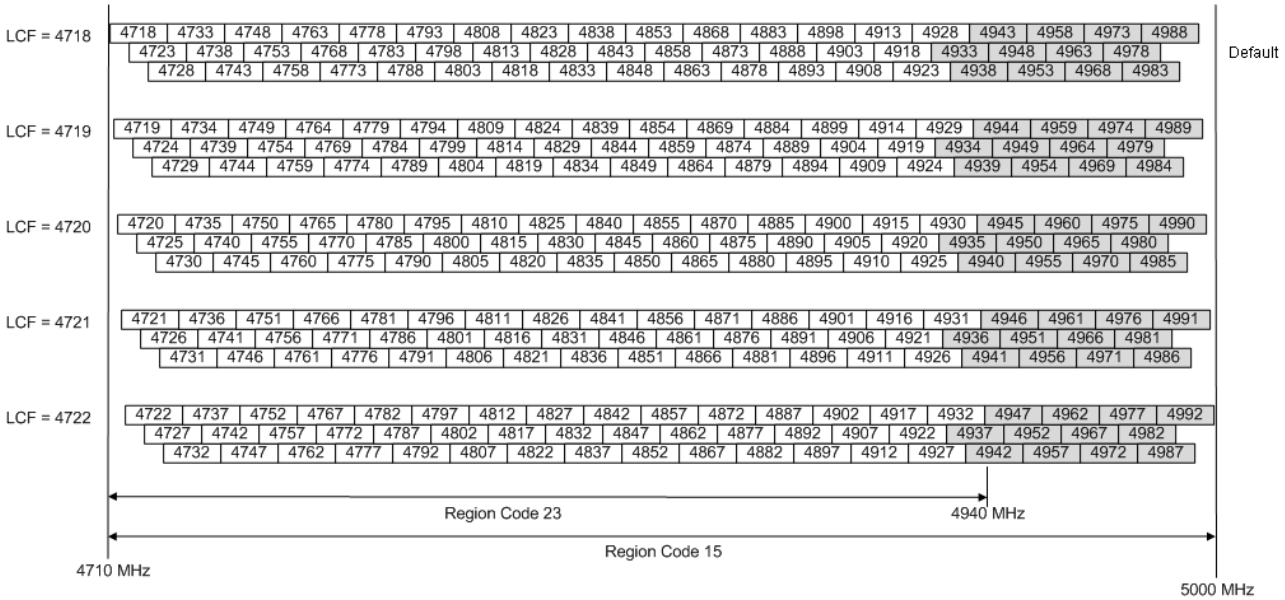


Figure 4-11 PTP 48600 available spectrum in 15 MHz channel bandwidth (RC 15 and 23)



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Figure 4-12 PTP 48600 available spectrum in the 10 MHz channel bandwidth (RC 15 and 23)

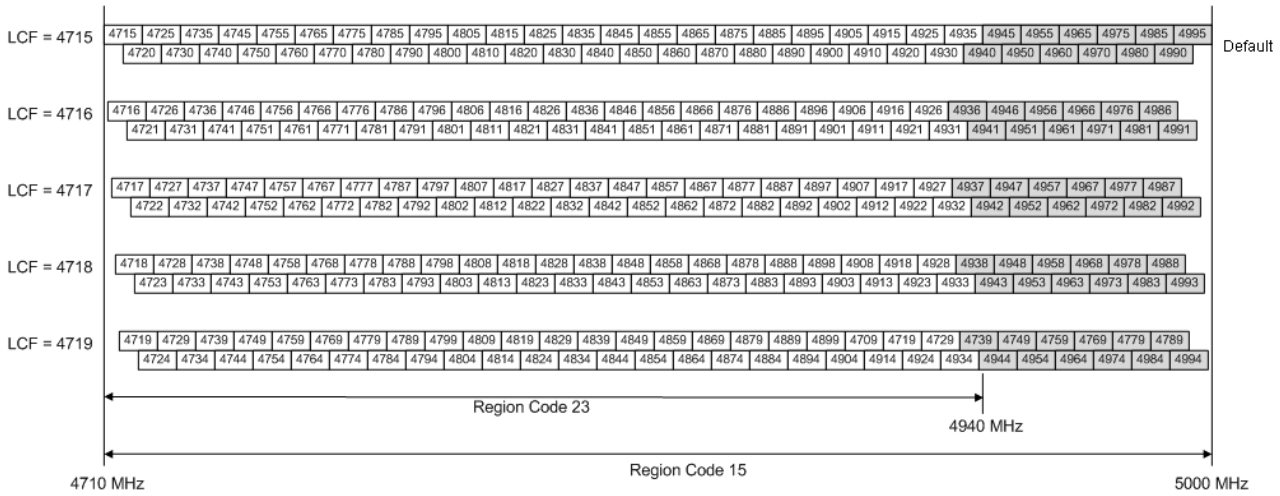
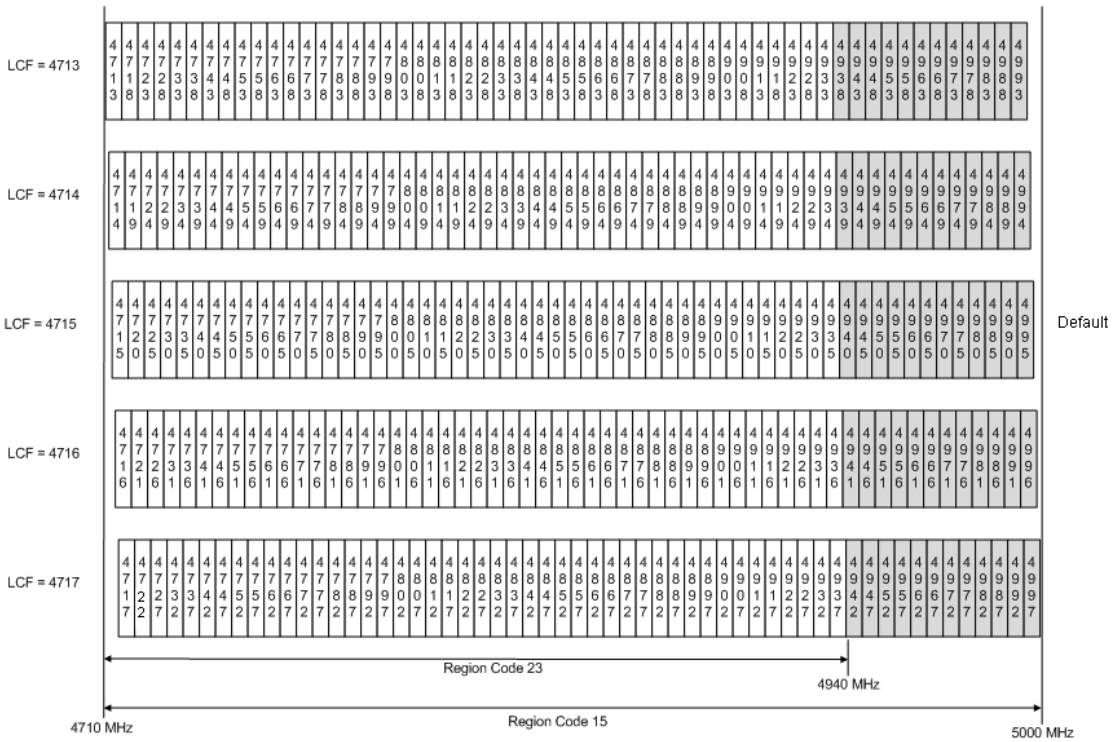


Figure 4-13 PTP 48600 available spectrum in 5 MHz channel bandwidth (RC 15 and 23)



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Region code 24 (NTIA)

In the 20 MHz (Figure 4-14) channel bandwidth, the PTP 48600 variant operates on a 20 MHz channel raster. In the 10 MHz (Figure 4-15) channel bandwidth, the PTP 48600 variant operates on a 10 MHz channel raster. The channel raster is set to even centre frequencies.

Figure 4-14 PTP 48600 available spectrum in the 20 MHz channel bandwidth (RC 24)

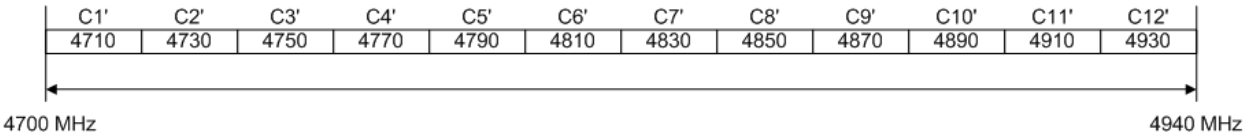
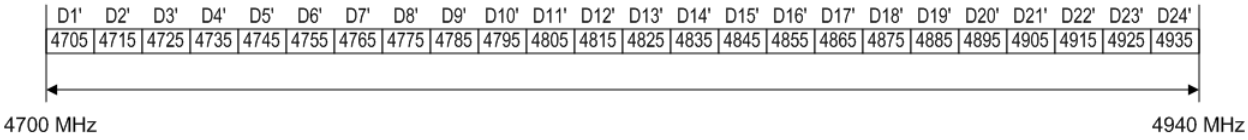


Figure 4-15 PTP 48600 available spectrum in 10 MHz channel bandwidth (RC 24)



PTP 49600 available spectrum settings

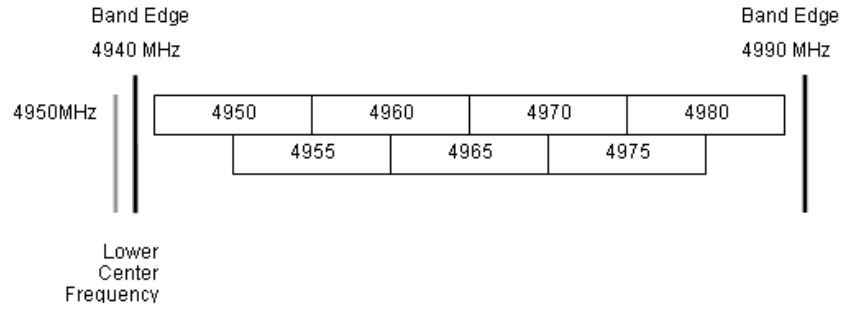
In the 20 MHz (Figure 4-16), 10 MHz (Figure 4-17) and 5 MHz (Figure 4-18) channel bandwidths, the PTP 49600 variant operates on a 5 MHz channel raster.

NOTE

These tables contain data for one typical region code. The specified channel centre frequencies may not be available in other region codes.

The PTP 49600 product variant does not apply any band edge power reduction.

Figure 4-16 PTP 49600 available spectrum in 20 MHz channel bandwidth



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Figure 4-17 PTP 49600 available spectrum in the 10 MHz channel bandwidth

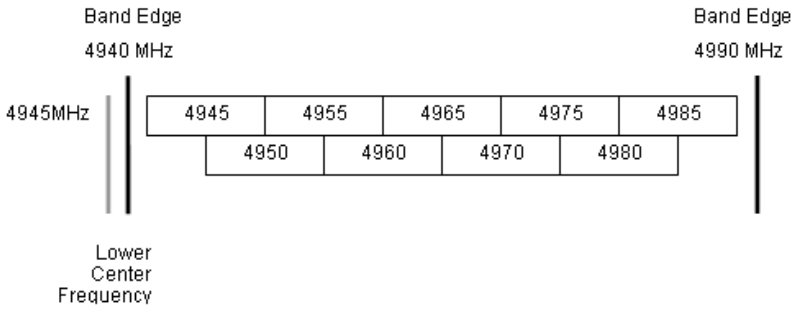
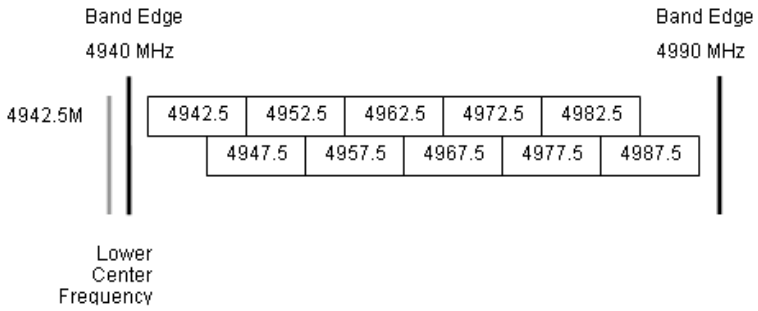


Figure 4-18 PTP 49600 available spectrum in the 5 MHz channel bandwidth



PTP 54600 available spectrum settings

Adjustment of the lower centre frequency allows the operator to slide the available frequency settings up and down the 5.4 GHz band in steps of 2 MHz.

In the 30 MHz channel bandwidth (Figure 4-19), the PTP 54600 variant operates on a 10 MHz channel raster. In the 15 MHz (Figure 4-20), 10 MHz (Figure 4-21) and 5 MHz (Figure 4-22) channel bandwidths, the PTP 54600 variant operates on a 6 MHz channel raster. The channel raster is set to even centre frequencies. The PTP 54600 product variant does not apply any band edge power reduction.

NOTE

These tables contain data for one typical region code. The specified channel centre frequencies may not be available in other region codes.

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Figure 4-19 PTP 54600 available spectrum in 30 MHz channel bandwidth

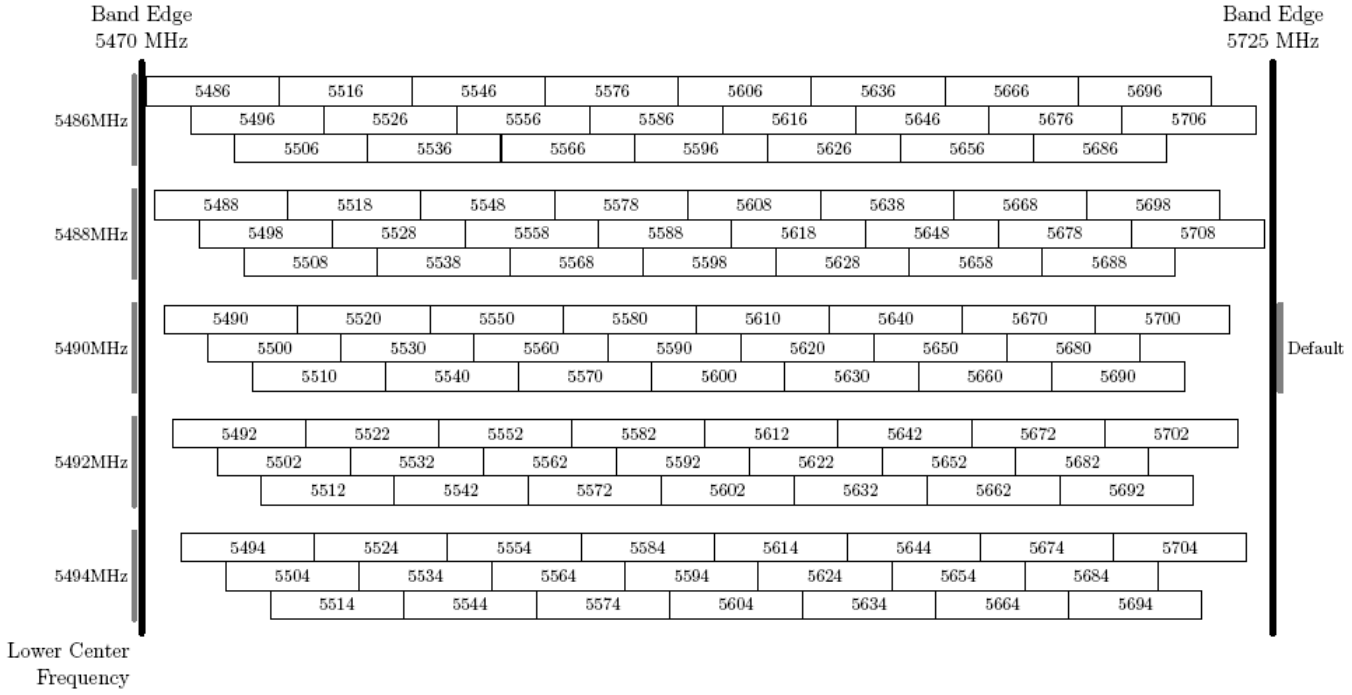
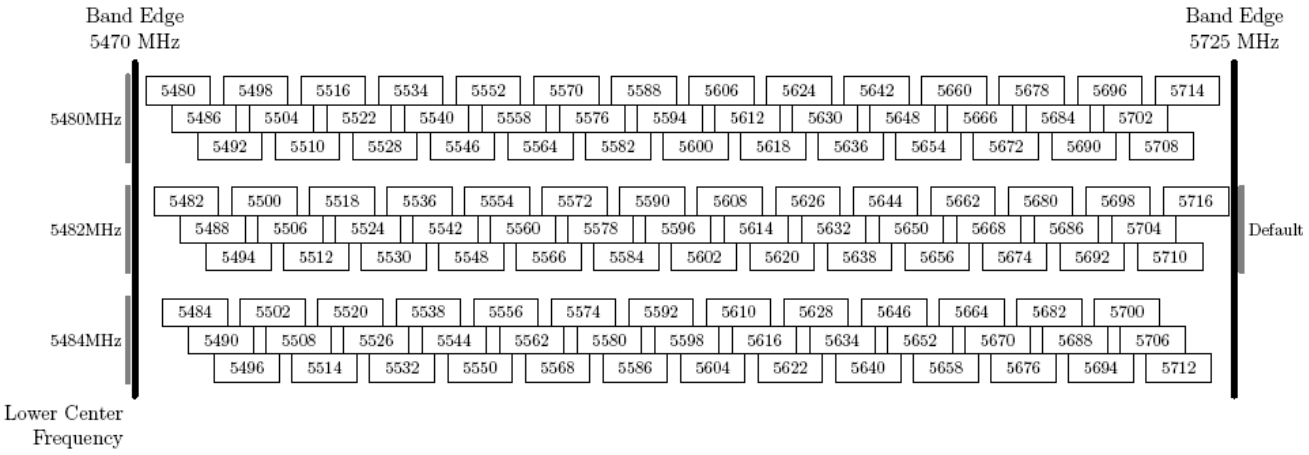


Figure 4-20 PTP 54600 available spectrum in 15 MHz channel bandwidth



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Figure 4-21 PTP 54600 available spectrum in 10 MHz channel bandwidth

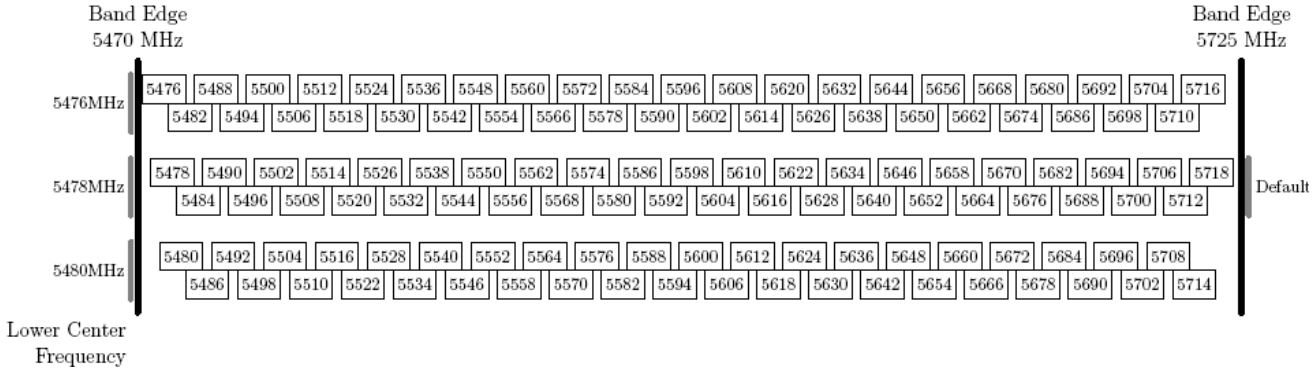
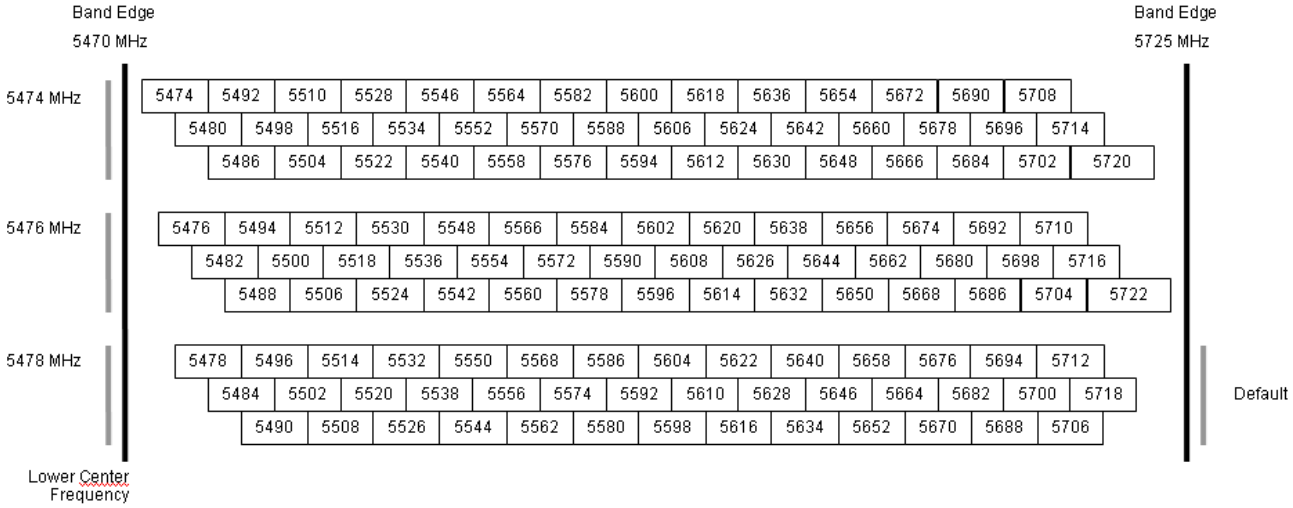


Figure 4-22 PTP 54600 available spectrum in 5 MHz channel bandwidth



PTP 58600 available spectrum settings

Adjustment of the lower centre frequency allows the operator to slide the available frequency settings up and down the 5.8 GHz band in steps of 2 MHz.

In the 30 MHz channel bandwidth (Figure 4-23), the PTP 58600 variant operates on a 10 MHz channel raster. In the 15 MHz (Figure 4-24), 10 MHz (Figure 4-25) and 5 MHz (Figure 4-26) channel bandwidths, the PTP 58600 variant operates on a 6 MHz channel raster. The channel raster is set to even centre frequencies.

NOTE

These tables contain data for one typical region code. The specified channel centre frequencies may not be available in other region codes.

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Figure 4-23 PTP 58600 available spectrum in 30 MHz channel bandwidth

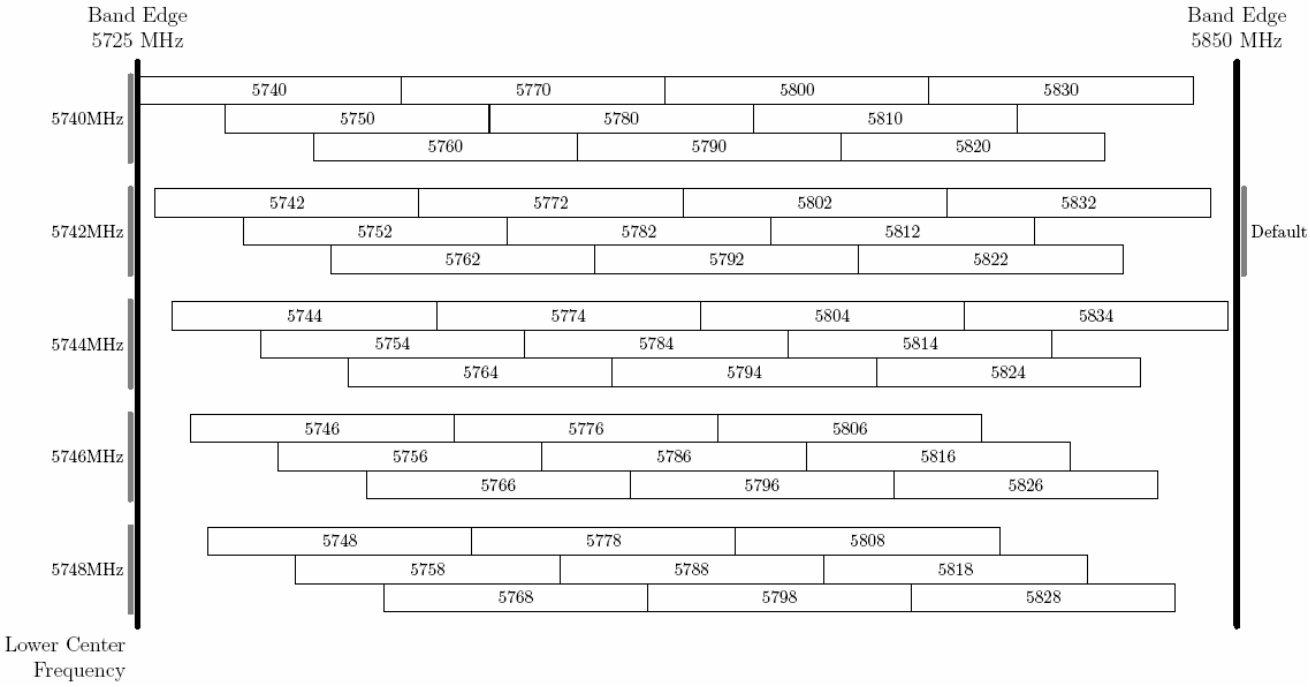
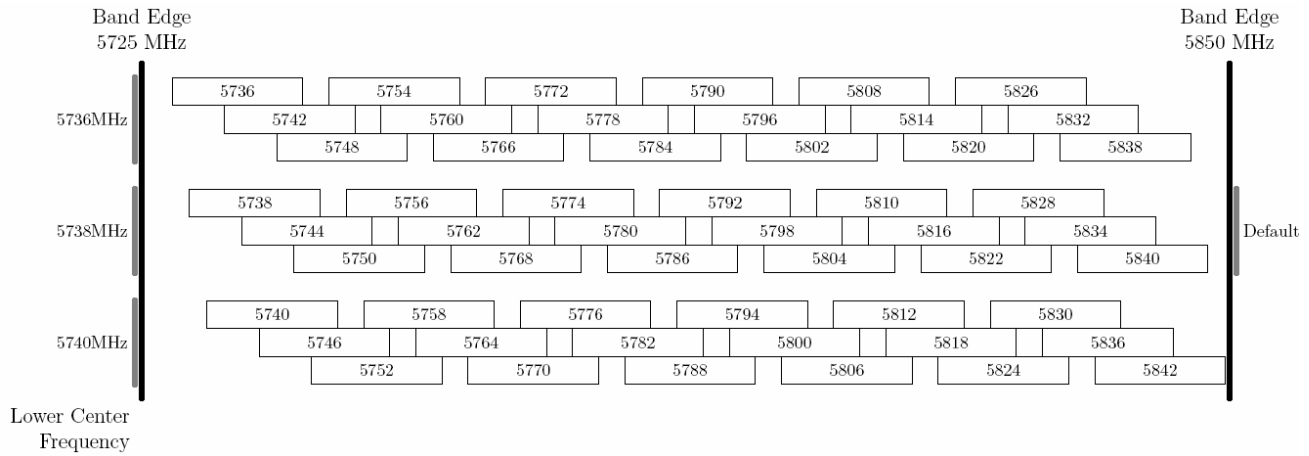


Figure 4-24 PTP 58600 available spectrum in 15 MHz channel bandwidth



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Figure 4-25 PTP 58600 available spectrum in the 10 MHz channel bandwidth

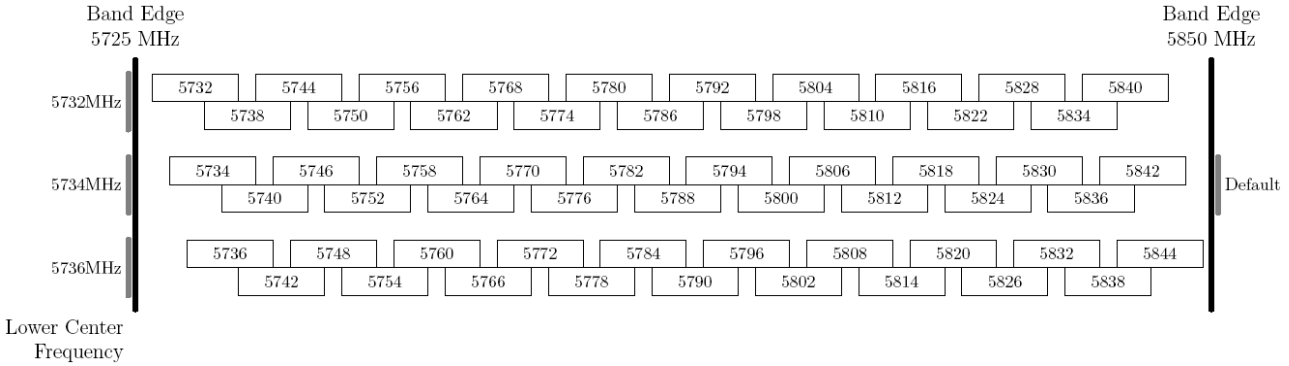
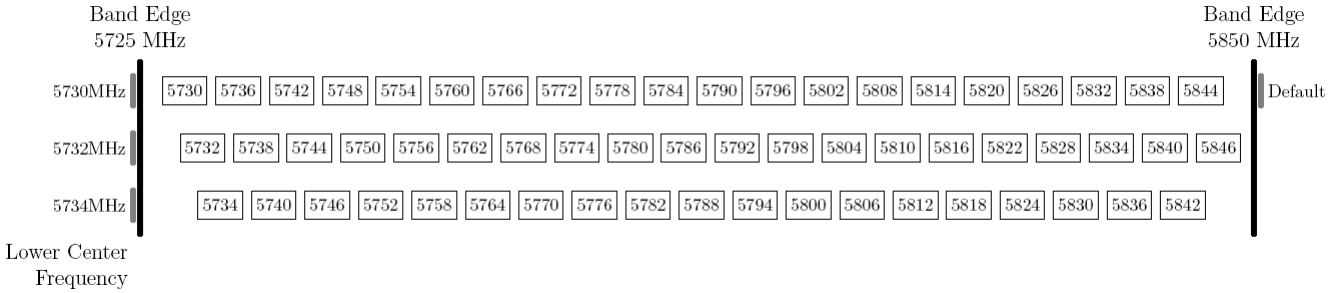


Figure 4-26 PTP 58600 available spectrum in 5 MHz channel bandwidth



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PTP 58600 transmit power reduction at the band edges

Operation at or near the 5.8 GHz band edges can results in a lower maximum transmit power. In some configurations the PTP 600 Series solution reduces the power when operating at the edge channels. The amount of reduction, if any, is dependant on the region code of the region of operation. This currently only affects systems configured with region code 1. The power reductions in the edge channels for 5 MHz, 10 MHz, 15 MHz and 30 MHz are presented in Table 4-38 (for region code 1 ONLY).

Table 4-38 PTP 58600 band edge Tx power reduction

Power Levels for Channel Centre	Channel Width (MHz)			
	5	10	15	30
5730	25	N/A	N/A	N/A
5732	25	23	N/A	N/A
5734	25	25	N/A	N/A
5736	25	25	23	N/A
5738	25	25	25	N/A
5740	25	25	25	17
5742 - 5750	25	25	25	21
5752 - 5822	25	25	25	25
5824 - 5832	25	25	25	21
5834	25	25	25	17
5840	25	25	23	N/A
5842	25	23	19	N/A
5844	25	19	N/A	N/A
5846	23	N/A	N/A	N/A

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PTP 59600 available spectrum settings

Adjustment of the lower centre frequency allows the operator to slide the available frequency settings up and down the 5.9 GHz band in steps of 2 MHz.

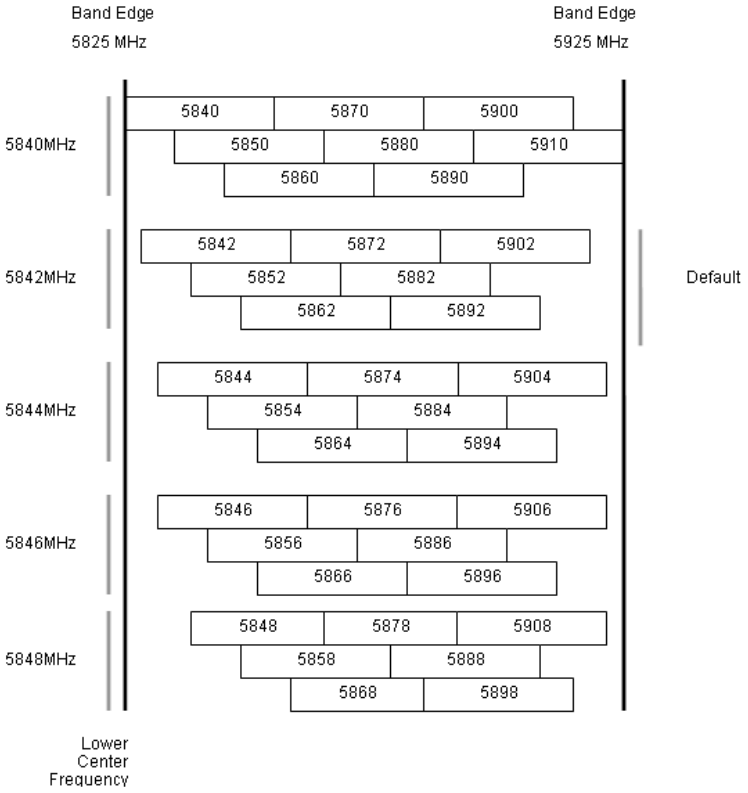
In the 30 MHz channel bandwidth (Figure 4-27) the PTP 59600 variant operates on a 10 MHz channel raster. In the 15 MHz (Figure 4-28), 10 MHz (Figure 4-29) and 5 MHz (Figure 4-30) channel bandwidths, the PTP 59600 variant operates on a 6 MHz channel raster. The channel raster is set to even centre frequencies.

NOTE

These tables contain data for one typical region code. The specified channel centre frequencies may not be available in other region codes.

The PTP 59600 product variant does not apply any band edge power reduction.

Figure 4-27 PTP 59600 available spectrum in 30 MHz channel bandwidth



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Figure 4-28 PTP 59600 available spectrum in 15 MHz channel bandwidth

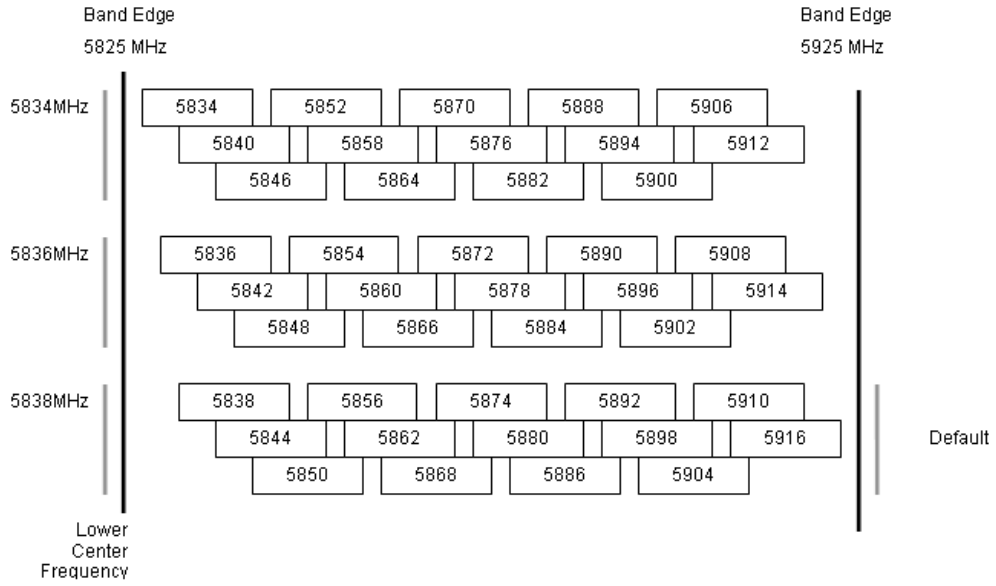
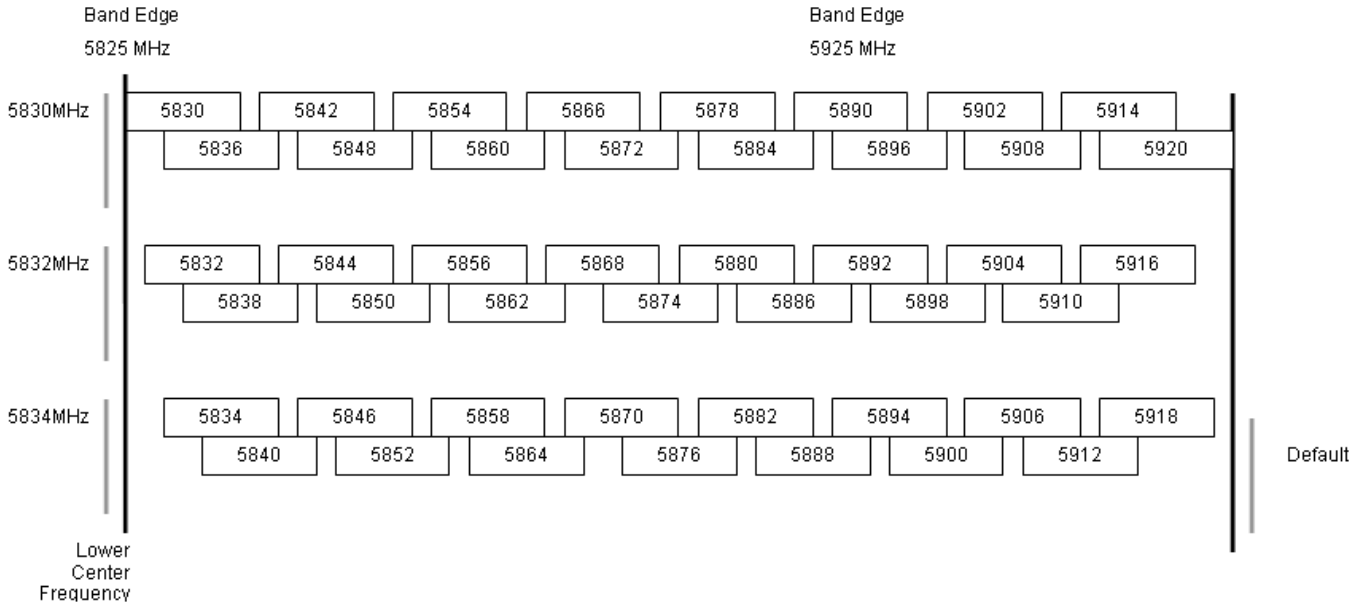


Figure 4-29 PTP 59600 available spectrum in 10 MHz channel bandwidth



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Figure 4-30 PTP 59600 available spectrum in 5 MHz channel bandwidth



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System threshold, output power and link loss

Table 4-39 PTP 25600 - IP mode - threshold, power and link loss

	Threshold Value (dBm)				Output Power (dBm)	Maximum Link Loss (dB)			
Channel Bandwidth / Modulation Mode	5 MHz	10 MHz	15 MHz	20 MHz	All Bands	5 MHz	10 MHz	15 MHz	20 MHz
BPSK 0.63 single	-97.6	-95.1	-93.0	-90.4	+23	156.6	154.1	152.0	149.4
QPSK 0.63 single	-93.9	-90.7	-90.5	-86.7	+23	152.9	149.7	146.6	145.7
QPSK 0.87 single	-90.7	-87.6	-87.5	-83.9	+23	149.7	146.6	146.5	142.9
16QAM 0.63 single	-89.1	-86.0	-86.0	-82.1	+23	148.0	145.5	145.0	140.4
16QAM 0.63 dual	-86.7	-83.9	-84.0	-79.4	+23	145.7	142.9	143.0	138.4
16QAM 0.87 single	-84.2	-82.5	-80.5	-76.5	+23	143.2	141.4	139.5	135.5
16QAM 0.87 dual	-81.0	-77.7	-77.4	-72.9	+23	140.0	136.6	136.4	131.9
64QAM 0.75 single	-81.6	-79.2	-77.4	-73.5	+23	140.6	138.2	136.4	132.4
64QAM 0.75 dual	-77.8	-74.7	-74.3	-69.8	+23	136.8	133.7	133.3	128.8
64QAM 0.92 single	-78.8	-76.3	-74.4	-70.3	+23	137.8	135.2	133.4	129.3
64QAM 0.92 dual	-75.5	-71.3	-71.9	-66.5	+23	134.5	130.3	130.9	125.5
256QAM 0.81 single	-77.2	-74.9	-72.9	-68.8	+23	136.2	133.9	131.9	127.8
256QAM 0.81 dual	-73.5	-70.1	-69.7	-65.1	+23	132.5	129.1	128.7	124.1

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Table 4-40 PTP 25600 - TDM mode - threshold, power and link loss

	Threshold Value (dBm)				Output Power (dBm)	Maximum Link Loss (dB)			
Channel Bandwidth / Modulation Mode	5 MHz	10 MHz	15 MHz	20 MHz	All Bands	5 MHz	10 MHz	15 MHz	20 MHz
BPSK 0.63 single	-97.6	-95.1	-93.0	-90.4	+23	156.6	154.1	152.0	149.4
QPSK 0.63 single	-91.6	-89.1	-88.2	-85.2	+23	150.6	148.1	147.2	144.2
QPSK 0.87 single	-88.3	-85.6	-85.1	-81.5	+23	147.3	144.6	144.1	140.5
16QAM 0.63 single	-86.4	-83.9	-83.5	-79.4	+23	145.4	142.9	142.5	138.4
16QAM 0.63 dual	-84.2	-80.8	-80.7	-76.6	+23	143.2	139.8	139.7	135.6
16QAM 0.87 single	-81.7	-78.1	-77.3	-73.6	+23	140.7	137.1	136.3	132.6
16QAM 0.87 dual	-78.6	-74.4	-74.3	-70.0	+23	137.6	133.4	133.3	129.0
64QAM 0.75 single	-78.8	-75.2	-74.2	-70.6	+23	137.8	134.2	133.2	129.6
64QAM 0.75 dual	-75.4	-71.0	-70.9	-66.7	+23	134.4	130.0	129.9	125.7
64QAM 0.92 single	-76.0	-73.4	-72.2	-68.6	+23	135.0	132.4	131.2	127.6
64QAM 0.92 dual	-73.5	-69.3	-68.9	-64.8	+23	132.5	128.2	127.9	123.8
256QAM 0.81 single	-73.4	-71.6	-69.1	-65.4	+23	132.4	130.6	128.1	124.4
256QAM 0.81 dual	-70.4	-67.6	-65.9	-61.6	+23	129.4	126.6	124.9	120.6

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Table 4-41 PTP 45600 - IP mode - threshold, power and link loss

	Threshold Value (dBm)					Output Power (dBm)	Maximum Link Loss (dB)				
Channel Bandwidth / Modulation Mode	5 MHz	10 MHz	15 MHz	20 MHz	30 MHz	All Bands	5 MHz	10 MHz	15 MHz	20 MHz	30 MHz
BPSK 0.63 single	-96.6	-93.7	-92.0	-90.4	-88.0	+27	166.6	163.7	162.0	160.4	158.0
QPSK 0.63 single	-92.0	-91.4	-89.3	-88.5	-85.8	+27	160.5	159.9	159.3	158.5	155.8
QPSK 0.87 single	-90.0	-87.6	-85.7	-84.9	-82.2	+27	160.0	157.6	155.7	154.9	152.2
16QAM 0.63 single	-88.3	-85.5	-83.3	-82.5	-80.1	+27	158.3	155.5	153.3	152.5	150.1
16QAM 0.63 dual	-85.5	-81.9	-79.5	-78.9	-77.1	+27	155.5	151.9	149.5	148.9	147.1
16QAM 0.87 single	-84.6	-80.7	-78.6	-77.8	-75.5	+27	154.6	150.7	148.6	147.8	145.5
16QAM 0.87 dual	-81.3	-77.3	-75.0	-74.3	-72.3	+27	151.3	147.3	145.0	144.3	142.3
64QAM 0.75 single	-81.2	-77.6	-75.5	-74.7	-72.4	+24	149.2	145.6	143.5	142.7	140.4
64QAM 0.75 dual	-78.2	-74.2	-71.8	-71.1	-69.3	+24	146.2	142.2	139.8	139.1	137.3
64QAM 0.92 single	-76.8	-73.1	-71.3	-70.0	-67.7	+24	144.8	141.1	139.3	138.0	135.7
64QAM 0.92 dual	-73.2	-69.4	-67.6	-66.9	-65.0	+24	141.2	137.4	135.6	134.9	133.0
256QAM 0.81 single	Not supported										
256QAM 0.81 dual											

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Table 4-42 PTP 45600 - TDM mode - threshold, power and link loss

	Threshold Value (dBm)					Output Power (dBm)	Maximum Link Loss (dB)				
Channel Bandwidth / Modulation Mode	5 MHz	10 MHz	15 MHz	20 MHz	30 MHz	All Bands	5 MHz	10 MHz	15 MHz	20 MHz	30 MHz
BPSK 0.63 single	-96.6	-93.7	-92.0	-90.4	-88.0	+27	166.6	163.7	162.0	160.4	158.0
QPSK 0.63 single	-90.4	-89.1	-87.8	-86.0	-83.1	+27	158.1	155.4	153.3	151.6	149.5
QPSK 0.87 single	-88.1	-85.4	-83.3	-81.6	-79.5	+27	160.3	159.1	157.8	156.0	153.1
16QAM 0.63 single	-86.1	-82.8	-80.7	-79.2	-77.2	+27	156.1	152.8	150.7	149.2	147.2
16QAM 0.63 dual	-82.5	-79.1	-77.2	-75.6	-73.9	+27	152.5	149.1	147.2	145.6	143.9
16QAM 0.87 single	-81.2	-78.2	-76.1	-74.4	-72.0	+27	151.2	148.2	146.1	144.4	142.0
16QAM 0.87 dual	-77.7	-74.4	-72.4	-70.8	-69.2	+27	147.7	144.4	142.4	140.8	139.2
64QAM 0.75 single	-77.7	-74.5	-72.4	-70.7	-68.6	+24	145.7	142.5	140.4	138.7	136.6
64QAM 0.75 dual	-74.2	-70.9	-69.1	-67.5	-65.9	+24	142.2	138.9	137.1	135.5	133.9
64QAM 0.92 single	-75.9	-72.2	-70.2	-68.6	-66.5	+24	143.9	140.2	138.2	136.6	134.5
64QAM 0.92 dual	-71.7	-68.5	-66.8	-65.4	-63.7	+24	139.7	136.5	134.8	133.4	131.7
256QAM 0.81 single	Not supported										
256QAM 0.81 dual											

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Table 4-43 PTP 48600 - IP mode - threshold, power and link loss

	System Threshold (dBm)				Output Power (dBm)		Maximum Link Loss (dB)			
Channel Bandwidth / **Modulation Mode**	5 MHz	10 MHz	15 MHz	20 MHz	5, 10, 15 MHz	20 MHz	5 MHz	10 MHz	15 MHz	20 MHz
BPSK 0.63 single	-98.6	-95.5	-93.3	-91.9	+27	+27	169.6	166.5	164.3	162.9
QPSK 0.63 single	-94.3	-90.7	-89.6	-87.5	+27	+27	165.3	161.7	160.6	158.5
QPSK 0.87 single	-90.8	-87.3	-85.9	-84.0	+27	+26	161.8	158.3	156.9	154.0
16QAM 0.63 single	-88.7	-85.2	-83.6	-81.8	+25	+25	157.7	154.2	152.6	150.8
16QAM 0.63 dual	-85.3	-81.6	-80.0	-78.5	+25	+25	154.3	150.6	149.0	147.5
16QAM 0.87 single	-84.4	-80.6	-78.8	-77.3	+25	+25	153.4	149.6	147.8	146.3
16QAM 0.87 dual	-81.0	-77.2	-75.9	-74.5	+25	+25	150.0	146.2	144.9	143.5
64QAM 0.75 single	-81.2	-77.7	-76.1	-74.7	+23	+23	148.2	144.7	143.1	141.7
64QAM 0.75 dual	-78.2	-74.7	-73.4	-71.9	+23	+23	145.2	141.7	140.4	138.9
64QAM 0.92 single	-77.0	-73.9	-72.7	-71.0	+21	+21	142.0	138.9	137.7	136.0
64QAM 0.92 dual	-74.0	-70.9	-69.7	-67.6	+21	+21	139.0	135.9	134.7	132.6
256QAM 0.81 single	-75.2	-71.9	-70.1	-68.0	+20	+20	139.2	135.9	134.1	132.0
256QAM 0.81 dual	-72.1	-68.4	-66.9	-64.5	+20	+20	136.1	132.4	130.9	128.5

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Table 4-44 PTP 48600 - TDM mode - threshold, power and link loss

	System Threshold (dBm)				Output Power (dBm)		Maximum Link Loss (dB)			
Channel Bandwidth / **Modulation Mode**	5 MHz	10 MHz	15 MHz	20 MHz	5, 10, 15 MHz	20 MHz	5 MHz	10 MHz	15 MHz	20 MHz
BPSK 0.63 single	-98.6	-95.5	-93.3	-91.9	+27	+27	169.6	166.5	164.3	162.9
QPSK 0.63 single	-91.4	-88.8	-87.8	-85.7	+27	+27	162.4	159.8	158.8	156.7
QPSK 0.87 single	-87.9	-85.2	-83.5	-81.9	+27	+26	158.9	156.2	154.5	151.9
16QAM 0.63 single	-85.4	-82.7	-81.1	-79.6	+25	+25	154.4	151.7	150.1	148.6
16QAM 0.63 dual	-81.9	-79.5	-77.8	-76.5	+25	+25	150.9	148.5	146.8	145.5
16QAM 0.87 single	-81.0	-78.2	-76.8	-75.5	+25	+25	150.0	147.2	145.8	144.5
16QAM 0.87 dual	-77.8	-75.4	-74.0	-72.5	+25	+25	146.8	144.4	143.0	141.5
64QAM 0.75 single	-77.9	-75.2	-73.9	-72.6	+23	+23	144.9	142.2	140.9	139.6
64QAM 0.75 dual	-75.0	-72.6	-71.1	-69.3	+23	+23	142.0	139.6	138.1	136.3
64QAM 0.92 single	-76.5	-73.9	-72.3	-70.7	+21	+21	141.5	138.9	137.3	135.7
64QAM 0.92 dual	-73.3	-71.0	-69.0	-67.2	+21	+21	138.3	136.0	134.0	132.2
256QAM 0.81 single	-75.1	-72.3	-70.8	-69.3	+20	+20	139.1	136.3	134.8	133.3
256QAM 0.81 dual	-71.7	-69.3	-67.3	-65.4	+20	+20	135.7	133.3	131.3	129.4

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Table 4-45 PTP 49600 - IP mode - threshold, power and link loss

	Threshold Value (dBm)			Output Power (dBm)	Maximum Link Loss (dB)		
Channel Bandwidth / **Modulation Mode**	5 MHz	10 MHz	20 MHz	All Bands	5 MHz	10 MHz	20 MHz
BPSK 0.63 single	-98.6	-95.5	-91.9	+24	166.6	163.5	159.9
QPSK 0.63 single	-94.3	-90.7	-87.5	+24	162.3	158.7	155.5
QPSK 0.87 single	-90.8	-87.3	-84.0	+24	158.8	155.3	152.0
16QAM 0.63 single	-88.7	-85.2	-81.8	+24	156.7	153.2	149.8
16QAM 0.63 dual	-85.3	-81.6	-78.5	+24	153.3	149.6	146.5
16QAM 0.87 single	-84.4	-80.6	-77.3	+24	152.4	148.6	145.3
16QAM 0.87 dual	-81.0	-77.2	-74.5	+24	149.0	145.2	142.5
64QAM 0.75 single	-81.2	-77.7	-74.7	+23	148.2	144.7	141.7
64QAM 0.75 dual	-78.2	-74.7	-71.9	+23	145.2	141.7	138.9
64QAM 0.92 single	-77.0	-73.9	-71.0	+21	142.0	138.9	136.0
64QAM 0.92 dual	-74.0	-70.9	-67.6	+21	139.0	135.9	132.6
256QAM 0.81 single	-75.2	-71.9	-68.0	+20	139.2	135.9	132.0
256QAM 0.81 dual	-72.1	-68.4	-64.5	+20	136.1	132.4	128.5

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Table 4-46 PTP 49600 - TDM mode - threshold, power and link loss

	Threshold Value (dBm)			Output Power (dBm)	Maximum Link Loss (dB)		
Channel Bandwidth / **Modulation Mode**	5 MHz	10 MHz	20 MHz	All Bands	5 MHz	10 MHz	20 MHz
BPSK 0.63 single	-98.6	-95.5	-91.9	+24	166.6	163.5	159.9
QPSK 0.63 single	-91.4	-88.8	-85.7	+24	159.4	156.8	153.7
QPSK 0.87 single	-87.9	-85.2	-81.9	+24	155.9	153.2	149.9
16QAM 0.63 single	-85.4	-82.7	-79.6	+24	153.4	150.7	147.6
16QAM 0.63 dual	-81.9	-79.5	-76.5	+24	149.9	147.5	144.5
16QAM 0.87 single	-81.0	-78.2	-75.5	+24	149.0	146.2	143.5
16QAM 0.87 dual	-77.8	-75.4	-72.5	+24	145.8	143.4	140.5
64QAM 0.75 single	-77.9	-75.2	-72.6	+23	144.9	142.2	139.6
64QAM 0.75 dual	-75.0	-72.6	-69.3	+23	142.0	139.6	136.3
64QAM 0.92 single	-76.5	-73.9	-70.7	+21	141.5	138.9	135.7
64QAM 0.92 dual	-73.3	-71.0	-67.2	+21	138.3	136.0	132.2
256QAM 0.81 single	-75.1	-72.3	-69.3	+20	139.1	136.3	133.3
256QAM 0.81 dual	-71.7	-69.3	-65.4	+20	135.7	133.3	129.4

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Table 4-47 PTP 54600 - IP mode - threshold, power and link loss

	Threshold Value (dBm)				Output Power (dBm)	Maximum Link Loss (dB)			
Channel Bandwidth / **Modulation Mode**	5 MHz	10 MHz	15 MHz	30 MHz	All Bands	5 MHz	10 MHz	15 MHz	30 MHz
BPSK 0.63 single	-98.2	-94.6	-92.3	-88.9	+25	169.2	165.6	163.3	159.9
QPSK 0.63 single	-93.0	-90.0	-88.5	-82.9	+24	163.0	160.0	158.5	152.9
QPSK 0.87 single	-90.2	-86.7	-85.3	-80.1	+23	159.2	155.7	154.3	149.1
16QAM 0.63 single	-88.0	-83.8	-82.8	-78.3	+22	156.0	151.8	150.8	146.3
16QAM 0.63 dual	-84.3	-80.7	-79.3	-74.6	+22	152.3	148.7	147.3	142.6
16QAM 0.87 single	-82.4	-79.1	-78.2	-73.0	+20	148.4	145.1	144.2	139.0
16QAM 0.87 dual	-79.7	-75.7	-74.7	-70.6	+20	145.7	141.7	140.7	136.6
64QAM 0.75 single	-78.9	-76.4	-74.9	-70.3	+18	142.9	140.4	138.9	134.3
64QAM 0.75 dual	-76.5	-72.7	-71.6	-67.7	+18	140.5	136.7	135.6	131.7
64QAM 0.92 single	-74.4	-71.7	-70.4	-65.0	+18	138.4	135.7	134.4	129.0
64 QAM 0.92 dual	-70.7	-68.5	-66.9	-62.3	+18	134.7	132.5	130.9	126.3
256QAM 0.81 single	N/A	N/A	N/A	-63.6	+18	N/A	N/A	N/A	127.6
256QAM 0.81 dual	N/A	N/A	N/A	-60.5	+18	N/A	N/A	N/A	124.5

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Table 4-48 PTP 54600 - TDM mode - threshold, power and link loss

	Threshold Value (dBm)				Output Power (dBm)	Maximum Link Loss (dB)			
Channel Bandwidth / **Modulation Mode**	5 MHz	10 MHz	15 MHz	30 MHz	All Bands	5 MHz	10 MHz	15 MHz	30 MHz
BPSK 0.63 single	-98.2	-94.6	-92.3	-88.9	+25	169.2	165.6	163.3	159.9
QPSK 0.63 single	-89.7	-88.3	-86.4	-81.4	+24	159.7	158.3	156.4	151.4
QPSK 0.87 single	-86.7	-84.3	-82.3	-78.4	+23	155.6	153.3	151.3	147.4
16QAM 0.63 single	-86.6	-81.8	-79.9	-76.0	+22	151.7	149.8	147.9	144.0
16QAM 0.63 dual	-83.7	-78.2	-76.5	-72.4	+22	148.8	146.3	144.5	140.4
16QAM 0.87 single	-78.8	-76.6	-75.5	-69.8	+20	144.8	142.6	141.5	135.8
16QAM 0.87 dual	-76.9	-73.9	-72.2	-68.7	+20	142.9	139.9	138.2	134.7
64QAM 0.75 single	-74.7	-72.2	-71.8	-66.6	+18	138.7	136.2	135.8	130.6
64QAM 0.75 dual	-73.0	-70.4	-68.8	-65.6	+18	137.0	134.4	132.8	129.6
64QAM 0.92 single	-70.9	-68.6	-67.4	-62.9	+18	134.9	132.6	131.4	126.9
64 QAM 0.92 dual	-68.2	-65.6	-64.2	-60.5	+18	132.1	129.6	128.2	124.5
256QAM 0.81 single	N/A	N/A	N/A	-65.4	+18	N/A	N/A	N/A	126.9
256QAM 0.81 dual	N/A	N/A	N/A	-60.5	+18	N/A	N/A	N/A	124.5

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Table 4-49 PTP 58600 - IP mode - threshold, power and link loss

	Threshold Value (dBm)				Output Power (dBm)	Maximum Link Loss (dB)			
Channel Bandwidth / **Modulation Mode**	5 MHz	10 MHz	15 MHz	30 MHz	All Bands	5 MHz	10 MHz	15 MHz	30 MHz
BPSK 0.63 single	-95.1	-92.5	-90.8	-86.3	+25	166.1	163.5	161.8	157.3
QPSK 0.63 single	-91.9	-90.0	-87.7	-83.0	+24	161.9	160.0	157.7	153.0
QPSK 0.87 single	-88.7	-86.6	-84.8	-80.3	+23	157.7	155.6	153.8	149.3
16QAM 0.63 single	-86.0	-84.3	-82.4	-78.3	+22	154.0	152.3	150.4	146.3
16QAM 0.63 dual	-83.5	-80.4	-78.5	-75.3	+22	151.5	148.4	146.5	143.3
16QAM 0.87 single	-82.1	-79.5	-78.1	-72.5	+20	148.1	145.5	144.1	138.5
16QAM 0.87 dual	-79.2	-76.2	-73.9	-71.5	+20	145.2	142.2	139.9	137.5
64QAM 0.75 single	-78.8	-76.7	-75.2	-69.2	+18	142.8	140.7	139.2	133.2
64QAM 0.75 dual	-76.1	-73.1	-71.0	-67.7	+18	140.1	137.1	135.0	131.7
64QAM 0.92 single	-74.4	-72.5	-66.2	-65.0	+18	138.4	136.5	134.6	129.0
64 QAM 0.92 dual	-70.2	-69.1	-70.7	-61.5	+18	134.2	133.1	130.2	125.5
256QAM 0.81 single	N/A	N/A	N/A	-64.0	+18	N/A	N/A	N/A	128.0
256QAM 0.81 dual	N/A	N/A	N/A	-59.6	+18	N/A	N/A	N/A	123.6

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Table 4-50 PTP 58600 - TDM mode - threshold, power and link loss

	Threshold Value (dBm)				Output Power (dBm)	Maximum Link Loss (dB)			
Channel Bandwidth / **Modulation Mode**	**5 MHz**	**10 MHz**	**15 MHz**	**30 MHz**	**All Bands**	**5 MHz**	**10 MHz**	**15 MHz**	**30 MHz**
BPSK 0.63 single	-95.1	-92.5	-90.8	-86.3	+25	166.1	163.5	161.8	157.3
QPSK 0.63 single	-88.7	-87.8	-86.0	-80.6	+24	158.7	157.8	155.9	150.6
QPSK 0.87 single	-85.5	-83.8	-81.6	-77.8	+23	154.5	152.8	150.6	146.8
16QAM 0.63 single	-82.0	-81.3	-79.1	-75.3	+22	150.0	149..3	147.1	143.3
16QAM 0.63 dual	-79.4	-77.6	-75.6	-71.7	+22	147.4	145.6	143.6	139.7
16QAM 0.87 single	-78.7	-76.3	-74.7	-71.2	+20	144.7	142.3	140.7	137.2
16QAM 0.87 dual	-75.1	-73.2	-71.0	-67.7	+20	141.0	139.2	137.0	133.7
64QAM 0.75 single	-74.4	-72.3	-70.6	-67.9	+18	138.4	136.3	134.6	131.9
64QAM 0.75 dual	-70.9	-69.5	-67.6	-64.0	+18	134.9	133.5	131.6	128.0
64QAM 0.92 single	-70.9	-68.0	-66.6	-63.1	+18	134.9	132.0	130.6	127.1
64 QAM 0.92 dual	-66.8	-64.6	-65.5	-58.7	+18	130.8	128.6	126.5	122.7
256QAM 0.81 single	N/A	N/A	N/A	-63.1	+18	N/A	N/A	N/A	127.1
256QAM 0.81 dual	N/A	N/A	N/A	-58.7	+18	N/A	N/A	N/A	122.7

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Table 4-51 PTP 59600 - IP mode - threshold, power and link loss

	Threshold Value (dBm)				Output Power (dBm)	Maximum Link Loss (dB)			
Channel Bandwidth / **Modulation Mode**	5 MHz	10 MHz	15 MHz	30 MHz	All Bands	5 MHz	10 MHz	15 MHz	30 MHz
BPSK 0.63 single	-97.1	-94.1	-92.0	-88.7	+25.0	168.1	165.1	163.0	159.7
QPSK 0.63 single	-90.7	-88.1	-87.1	-82.5	+24.0	160.7	158.1	157.1	152.5
QPSK 0.87 single	-87.2	-84.4	-83.5	-79.3	+23.0	156.2	153.4	152.5	148.3
16QAM 0.63 single	-85.0	-81.9	-81.2	-77.1	+22.0	153.0	149.9	149.2	145.1
16QAM 0.63 dual	-81.9	-78.8	-77.5	-73.5	+22.0	149.9	146.8	145.5	141.5
16QAM 0.87 single	-80.9	-78.0	-76.7	-72.9	+20.0	146.9	143.9	142.7	138.9
16QAM 0.87 dual	-76.5	-73.9	-73.2	-70.0	+20.0	142.5	139.9	139.2	136.0
64QAM 0.75 single	-77.0	-74.6	-73.6	-70.3	+18.0	141.0	138.6	137.6	134.3
64QAM 0.75 dual	-73.1	-71.0	-70.4	-67.5	+18.0	137.1	135.0	134.4	131.5
64QAM 0.92 single	-72.1	-71.0	-68.9	-65.7	+18.0	136.1	135.0	132.9	129.7
64 QAM 0.92 dual	-70.2	-67.2	-66.1	-62.1	+18.0	134.2	131.1	130.1	126.1
256QAM 0.81 single	N/A	N/A	N/A	-63.9	+18.0	N/A	N/A	N/A	127.9
256QAM 0.81 dual	N/A	N/A	N/A	-59.9	+18.0	N/A	N/A	N/A	123.9

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Table 4-52 PTP 59600 - TDM mode - threshold, power and link loss

	Threshold Value (dBm)				Output Power (dBm)	Maximum Link Loss (dB)			
Channel Bandwidth / **Modulation Mode**	5 MHz	10 MHz	15 MHz	30 MHz	All Bands	5 MHz	10 MHz	15 MHz	30 MHz
BPSK 0.63 single	-97.1	-94.1	-92.0	-88.7	+25.0	168.1	165.1	163.0	159.7
QPSK 0.63 single	-88.5	-86.1	-84.4	-79.4	+24.0	158.5	156.1	154.4	149.4
QPSK 0.87 single	-84.6	-81.9	-80.1	-76.0	+23.0	153.6	150.9	149.1	145.0
16QAM 0.63 single	-82.5	-79.6	-77.8	-73.7	+22.0	150.4	147.6	145.8	141.7
16QAM 0.63 dual	-78.8	-76.0	-74.1	-70.4	+22.0	146.8	144.0	142.1	138.4
16QAM 0.87 single	-78.3	-75.1	-73.7	-70.2	+20.0	144.3	141.1	139.7	136.2
16QAM 0.87 dual	-74.2	-71.6	-70.2	-66.9	+20.0	140.2	137.6	134.2	132.9
64QAM 0.75 single	-74.7	-71.4	-70.2	-67.3	+18.0	138.7	135.4	134.2	131.3
64QAM 0.75 dual	-70.9	-68.3	-66.8	-63.6	+18.0	134.8	132.2	130.8	127.6
64QAM 0.92 single	-71.2	-68.1	-67.0	-63.3	+18.0	135.2	132.0	131.0	127.3
64 QAM 0.92 dual	-66.7	-64.2	-62.7	-58.7	+18.0	130.7	128.2	126.7	122.7
256QAM 0.81 single	N/A	N/A	N/A	-63.3	+18.0	N/A	N/A	N/A	127.3
256QAM 0.81 dual	N/A	N/A	N/A	-58.7	+18.0	N/A	N/A	N/A	122.7

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Data network specifications

Ethernet interfaces

The PTP 600 Ethernet ports conform to the specifications listed in Table 4-53 and Table 4-54.

Table 4-53 PTP 600 Ethernet bridging specifications

Ethernet Bridging	Specification
Protocol	IEEE802.1; IEEE802.1p; IEEE802.3 compatible
QoS	IEEE 802.1p (eight levels), IEEE 802.1Q, IEEE 802.1ad
Interface	10/100/1000BaseT (RJ-45), Supports MDI/MDIX Auto Crossover
Data Rates	See Data rate calculations on page 4-114.
Maximum Ethernet Frame Size	2000 bytes

NOTE

Practical Ethernet rates will depend on network configuration, higher layer protocols and platforms used.

Over the air throughput will be capped to the rate of the Ethernet interface at the receiving end of the link.

Table 4-54 PTP 600 telecoms interface specifications

Telecoms	Specification
Interfaces	2 E1 balanced 120R or 2 T1 balanced 100R over a CAT5 screened twisted pair cable
Jitter and Wander	Compliant with G.823/ G.824.
Surge Protection and Power Cross	Compliant with GR1089, EN60950.

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System management data

SNMPv3 default configuration (MIB-based)

When SNMPv3 MIB-based Security Mode is enabled, the default configuration for the `usmUserTable` table is based on one initial user and four template users as listed in Table 4-55.

Table 4-55 Default SNMPv3 users

Object	Entry 1
Name	initial
SecurityName	initial
AuthProtocol	usmHMACMD5AuthProtocol
PrivProtocol	usmDESPrivProtocol
StorageType	nonVolatile

Object	Entry 2	Entry 3
Name	templateMD5_DES	templateSHA_DES
SecurityName	templateMD5_DES	templateSHA_DES
AuthProtocol	usmHMACMD5AuthProtocol	usmHMACSAHAuthProtocol
PrivProtocol	usmDESPrivProtocol	usmDESPrivProtocol
StorageType	nonVolatile	nonVolatile

Object	Entry 4	Entry 5
Name	templateMD5_AES	templateSHA_AES
SecurityName	templateMD5_AES	templateSHA_AES
AuthProtocol	usmHMACMD5AuthProtocol	usmHMACSHAAuthProtocol
PrivProtocol	usmAESPrivProtocol	usmAESPrivProtocol
StorageType	nonVolatile	nonVolatile

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VACM default configuration

The default user `initial` is assigned to VACM group `initial` in the `vacmSecurityToGroupTable` table. The template users are not assigned to a group.

PTP 600 creates default view trees and access as shown in Table 4-56 and Table 4-57.

Table 4-56 Default VACM view trees

Object	Entry 1	Entry 2
ViewName	internet	restricted
Subtree	1.3.6.1	1.3.6.1
Mask	“”	“”
Type	included	included
StorageType	nonVolatile	nonVolatile

Table 4-57 Default data fill for access table

Object	Entry 1	Entry 2
GroupName	initial	initial
ContextPrefix	“”	“”
SecurityLevel	authNoPriv	noAuthNoPriv
ContextMatch	exact	exact
ReadViewName	internet	restricted
WriteViewName	internet	“”
NotifyViewName	internet	restricted
StorageType	nonVolatile	nonVolatile

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RADIUS protocols and attributes

RADIUS is implemented in PTP 600 with the following protocols and attributes:

- Standard RADIUS attributes (Table 4-58)
- Vendor specific RADIUS attributes (Table 4-59)
- RADIUS protocol interaction (Table 4-60)

Table 4-58 Standard RADIUS attributes

Attribute	Type	Description
session-timeout	27	The session timeout attribute MUST dictate that maximum session length for any user. If session timeout is not present in the RADIUS authentication response then an infinite session timeout MUST be assumed.
Idle-timeout	28	The idle timeout MUST dictate the maximum idle time before a session is terminated. The idle time attribute is directly analogous to the PTP600 cookie expiry time attribute. If the idle time attribute is present in the RADIUS response then this MUST be used in place of any configured cookie expiry time.

Table 4-59 Vendor specific RADIUS attributes

VSA	Type	Vendor Company Code	Vendor Type	Description
auth-role	26	17713	1	The auth-role attribute is used to return the users permitted role: 0 - invalid-role 1 - readonly-role 2 - system-admin-role 3 - security-officer-role

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Table 4-60 RADIUS protocol interaction for each user role

Service-type	Role not present	invalid-role	readonly-role	system-admin-role	security-officer-role
not-present	read only	reject login	read only	reject login	reject login
login-user	read only	reject login	read only	reject login	reject login
administrative	sys admin	reject login	reject login	sys admin	security officer
invalid service type	reject login	reject login	reject login	reject login	reject login

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Email alerts

The management agent can be configured to generate alerts by electronic mail when any of the following events occur:

- Wireless Link Up/Down
- DFS Channel Change
- DFS Impulse Interference
- Ethernet Link Up/Down
- Region Code
- Install Status
- Install Arm State
- Unit Out Of Calibration
- Incompatible Region Codes
- Incompatible Master And Slave
- Ethernet Configuration Mismatch
- No Wireless Channel Available
- SNTP Synchronization Failed
- Wireless Link Disabled Warning
- Ethernet Link Disabled Warning
- Ethernet Link Status
- Fiber Link Status
- Telecoms Channel A Status
- Telecoms Channel B Status
- Telecoms Channel A Loopback
- Telecoms Channel B Loopback
- TDD Synchronization Alarm
- Link Mode Optimization Mismatch

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Event notification messages

When system logging is enabled, event notification messages may be output in the following categories:

- Local log messages (Table 4-61)
- Standard log messages (Table 4-62)
- SNMPv3 messages (Table 4-63)
- Authentication messages (Table 4-64)
- Authentication configuration messages (Table 4-65)
- Telnet messages (Table 4-66)
- TFTP messages (Table 4-67)
- RADIUS messages (Table 4-68)
- Security configuration messages (Table 4-69)
- License key messages (Table 4-70)
- Management messages (Table 4-71)
- SNTP messages (Table 4-72)
- Low resource messages (Table 4-73)

NOTE

System logging is described in System logging (syslog) on page 1-51.

The system logging configuration procedure is described in Task 15: Configure syslog on page 6-108.

The full text in the syslog message consists of:

```
event:[SYSLOG message];[message text]
```

For example, the full text of the log-full event in Table 4-61 is:

```
event:log-full; Message Syslog local flash log is 90% full
```


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The Facility attribute has numeric values as follows:

- 0: Kernel messages
- 4: Security/authorization messages

The Severity attribute has numeric values as follows:

- 1: Alert: Action must be taken immediately
- 3: Error: Error conditions
- 4: Warning: Warning conditions
- 6: Info: Informational messages

Table 4-61 Local log messages

Facility	Severity	Message content (process tag; message text)
Kernel	Warning	log_full; Syslog local flash log is 90% full
Kernel	Warning	log_wrap; Syslog local flash log has wrapped
Kernel	Warning	log_control; Syslog local flash log [enabled|disabled]

Table 4-62 Standard log messages

Facility	Severity	Message content (process tag; message text)
Kernel	Info	cold_start; PTP wireless bridge has reinitialized, reason=[Reset reason]
Kernel	Info	link_up; Wireless link up
Kernel	Error	link_down; Wireless link down

Table 4-63 SNMPv3 messages

Facility	Severity	Message content (process tag; message text)
Kernel	Alert	snmpv3_auth; Authentication failure
Security	Warning	snmpv3_asn1; ASN.1 parse error
Security	Warning	snmpv3_engine_id; Unknown engine ID
Security	Warning	snmpv3_sec_level; Unknown security level
Security	Warning	snmpv3_decryption; Decryption failure

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Table 4-64 Authentication messages

Facility	Severity	Message content (process tag; message text)
Security	Info	auth_login; Web user=[user name]; from=[IP Address]; port=[Port Number]; connection=[HTTP|HTTPS]; authentication=[local|RADIUS];
Security	Warning	auth_login_failed; Web user=[user name]; from=[IP Address]; port=[Port Number]; connection=[HTTP|HTTPS]; authentication=[local|RADIUS];
Security	Info	auth_logout; Web user=[user name]; from=[IP Address]; port=[Port Number]; connection=[HTTP|HTTPS]; authentication=[local|RADIUS];
Security	Warning	auth_idle; Web session terminated
Security	Warning	auth_login_locked; Web user=[user name]; from=[IP Address]; port=[Port Number]; connection=[HTTP|HTTPS]; authentication=[local|RADIUS];

Table 4-65 Authentication configuration messages

Facility	Severity	Message content (process tag; message text)
Security	Warning	auth_cfg_logout; Auto Logout Period changed from x to y minutes
Security	Warning	auth_cfg_attempts; Maximum Number Of Login Attempts changed from x to y
Security	Warning	auth_cfg_lockout; Login Attempt Lockout Period changed from x to y minutes
Security	Warning	auth_cfg_lockout_action; Login Attempt Lockout Action changed to [new value]
Security	Warning	auth_cfg_pass_change; Minimum Password Change Period changed from x to y minutes
Security	Warning	auth_cfg_pass_expiry; Password Expiry Period changed from x to y days

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Facility	Severity	Message content (process tag; message text)
Security	Warning	auth_cfg_pass_expiry_action; Password Expiry Action changed to [new value]
Security	Warning	auth_cfg_session; Webpage Session Control [enabled|disabled]
Security	Warning	auth_cfg_identity; Identity Based User Accounts [enabled|disabled]

Table 4-66 Telnet messages

Facility	Severity	Message content (process tag; message text)
Security	Warning	telnet_enable; Telnet service [enabled|disabled]
Security	Info	telnet_login; Telnet user=[user name]; from=[IP Address]; port=[Port Number];
Security	Warning	telnet_login_failed; Telnet user=[user name]; from=[IP Address]; port=[Port Number];
Security	Info	telnet_logout; Telnet user=[user name]; from=[IP Address]; port=[Port Number];
Security	Warning	telnet_idle; Telnet session terminated
Security	Warning	telnet_port; Telnet Port changed from x to y

Table 4-67 TFTP messages

Facility	Severity	Message content (process tag; message text)
Security	Warning	tftp_cfg_ip; TFTP IP Address changed from [IP Address] to [IP Address][status]
Security	Warning	tftp_cfg_port; TFTP Port changed from x to y
Security	Warning	tftp_cfg_filename; TFTP software upgrade filename updated
Security	Info	tftp_start; TFTP software upgrade started
Security	Info	tftp_complete; TFTP software upgrade finished
Security	Warning	tftp_failure; TFTP software upgrade failed, reason=[reason]

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Table 4-68 RADIUS messages

Facility	Severity	Message content (process tag; message text)
Security	Warning	radius_enable; RADIUS service [enabled|disabled]
Security	Warning	radius_cfg_primary; RADIUS Primary Server changed from x to y
Security	Warning	radius_cfg_dead_time; RADIUS Primary Server Dead Time changed from x to y minutes
Security	Warning	radius_cfg_retries; RADIUS Server Retries changed from x to y
Security	Warning	radius_cfg_timeout; RADIUS Server Timeout changed from x to y seconds
Security	Warning	radius_cfg_ip_address; RADIUS Server N, IP Address changed from [IP Address] to [IP Address]
Security	Warning	radius_cfg_auth_port; RADIUS Server N, Authentication Port changed from [Port Number] to [Port Number]
Security	Warning	radius_cfg_secret; RADIUS Server N, Shared Secret changed
Security	Warning	radius_auth_fail; RADIUS user [user name]; server N at [IP Address] failed[status msg]
Security	Info	radius_auth; RADIUS user [user name]; server N at [IP Address] succeeded

Table 4-69 Security configuration messages

Facility	Severity	Message content (process tag; message text)
Security	Warning	sec_key_of_keys; Key Of Keys updated
Security	Warning	sec_rsa_private; RSA Private Key updated
Security	Warning	sec_rsa_public; RSA Public Certificate updated
Security	Warning	sec_banner; User Defined Security Banner updated
Security	Warning	sec_drng; DRNG Entropy updated
Security	Warning	sec_aes_wireless_key; Wireless Encryption Key updated

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Facility	Severity	Message content (process tag; message text)
Security	Warning	sec_aes_wireless_algorithm; Wireless Encryption Algorithm changed from x to y bits
Security	Warning	sec_http; HTTP service [enabled|disabled]
Security	Warning	sec_http_port; HTTP Port changed from x to y
Security	Warning	sec_https; HTTPS service [enabled|disabled]
Security	Warning	sec_https_port; HTTPS Port changed from x to y
Security	Warning	sec_zeroize; Critical Security Parameters (CSPs) zeroized
Security	Warning	sec_pass_min_len; Minimum Password Length changed from x to y
Security	Warning	sec_pass_user_name; Password Can Contain User Name [enabled|disabled]
Security	Warning	sec_pass_specific; Minimum Number Of [Lowercase|Uppercase|Numeric|Special] Characters changed from x to y
Security	Warning	sec_pass_repeated; Maximum Repeated [Alphabetic|Numeric|Special] Characters changed from x to y
Security	Warning	sec_pass_consecutive; Maximum Consecutive [Lowercase|Uppercase|Numeric] Characters changed from x to y
Security	Warning	sec_pass_max_series; Maximum Sequential [Alphabetic|Numeric] Characters changed from x to y
Security	Warning	sec_pass_pattern; Maximum Repeated Pattern Length changed from x to y
Security	Warning	sec_pass_reverse; Match Reversed Patterns [enabled|disabled]
Security	Warning	sec_pass_min_changed; Minimum Characters That Must Change changed from x to y
Security	Warning	sec_pass_reuse; Password Reuse [enabled|disabled]
Security	Warning	sec_pass_specials; Special Characters updated

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Table 4-70 License key messages

Facility	Severity	Message content (process tag; message text)
Security	Warning	license_update; License Key updated

Table 4-71 Management messages

Facility	Severity	Message content (process tag; message text)
Security	Warning	sys_software_upgrade; Software upgraded from [version] to [version]
Kernel	Alert	sys_reboot; System Reboot, reason=[Reset reason]

Table 4-72 SNTP messages

Facility	Severity	Message content (process tag; message text)
Security	Warning	time_client; SNTP client [enabled|disabled]
Security	Alert	time_lost_sync; Lost sync with SNTP server

Table 4-73 Low resource messages

Facility	Severity	Message content (process tag; message text)
Security	Alert	resource_low; Potential DoS attack on packet ingress ([warning|cleared])

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Safety compliance

Electrical safety compliance

The PTP 600 hardware has been tested for compliance to the electrical safety specifications listed in Table 4-74.

Table 4-74 PTP 600 safety compliance specifications

Region	Specification
USA	UL 60950
Canada	CSA C22.2 No.60950
International	CB certified & certificate to IEC 60950

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Electromagnetic compliance

EMC immunity compliance

The PTP 600 complies with European EMC Specification EN301 489-1 with testing carried out to the detailed requirements of EN301 489-4.

NOTE

For EN 61000-4-2: 1995 Electro Static Discharge (ESD), Class 2, 8 kV air, 4 kV contact discharge, the PTP 600 has been tested to ensure immunity to 15 kV air and 8 kV contact.

Table 4-75 lists the EMC specification type approvals that have been granted for PTP 600 frequency variants.

Table 4-75 EMC emissions compliance

Variant	Region	Specification (Type Approvals)
PTP 25600	USA	FCC Part 15 (Class B)
PTP 45600	US Federal	
PTP 48600	US Federal	
PTP 49600	USA	FCC Part 15B
PTP 54600	USA	FCC Part 15 Class B
	Canada	CSA Std C108.8, 1993 Class B
	Europe	EN55022 CISPR 22
PTP 58600	USA	FCC Part 15 Class B
	Canada	CSA Std C108.8, 1993 Class B
	Europe	EN55022 CISPR 22

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Radio certifications

Table 4-75 lists the radio specification type approvals that have been granted for PTP 600 frequency variants.

Table 4-76 Radio certifications

Variant	Region	Specification (Type Approvals)
PTP 49600	USA	FCC Part 90
	Canada	RSS-111
PTP 54600	USA	FCC Part 15 E
	Canada	RSS 210 Issue 7, Annex 9
	Europe	EN301 893 V1.5.1 with DFS testing using radar parameters
PTP 58600	USA	FCC Part 15.247
	CANADA	RSS 210 Issue 7, Annex 8
	UK	IR 2007
	Eire	ComReg 02/71R1
	EU	EN302 502 v 1.2.1

Compliance with regulations

Changes or modifications not expressly approved by Motorola could void the user's authority to operate the system.

This system has achieved Type Approval in various countries around the world. This means that the system has been tested against various local technical regulations and found to comply. The frequency bands in which the system operates may be 'unlicensed' and, in these bands, the system can be used provided it does not cause interference. Further, it is not guaranteed protection against interference from other products and installations.

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⚠ CAUTION

When planning a link that will use Connectorized PTP 600 Series (with external antennas), ensure that regulatory requirements are met for the installation, as described in Regulatory issues with connectorized units on page 4-94.

FCC and ETSI compliance testing (without PTP-SYNC)

Without PTP-SYNC installed, the system has been tested for compliance to both US (FCC) and European (ETSI) specifications. It has been shown to comply with the limits for emitted spurious radiation for a Class B digital device, pursuant to Part 15 of the FCC Rules in the USA and appropriate European ENs. These limits have been designed to provide reasonable protection against harmful interference. However the equipment can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to other radio communications. There is no guarantee that interference will not occur in a particular installation.

NOTE

A Class B Digital Device is a device that is marketed for use in a residential environment, notwithstanding use in commercial, business and industrial environments.

NOTE

Notwithstanding that Motorola has designed (and qualified) the PTP 600 products to generally meet the Class B requirement to minimize the potential for interference, the PTP 600 product range is not marketed for use in a residental environment.

FCC and ETSI compliance testing (with PTP-SYNC)

With PTP-SYNC installed, this equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules and with RSS-GEN of Industry Canada. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

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NOTE

A Class A Digital Device is a device that is marketed for use in a commercial, industrial or business environment, exclusive of a device which is marketed for use by the general public or is intended to be used in the home.

Radio and television interference

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the Outdoor Unit (ODU).
- Increase the separation between the affected equipment and ODU.
- Connect the ODU and PIDU Plus into a power outlet on a circuit different from that to which the receiver is connected.
- Consult your installer or supplier for help.

Deployment and operation

The Radio Regulations of various countries' limits constrain the operation of radio products generally. In particular the local regulator may limit the amount of conducted or radiated transmitter power and may require registration of the radio link.

The power transmitted by the PTP 600 Series is controlled by the use of Region-specific License Keys. Contact your supplier/installer to ensure that your product is set for the correct License Key for your Country/Region and to ensure that you have fulfilled all the local regulatory requirements, especially if you are intending to use a link with external antennas.

Examples of regulatory limits

For examples of how the regulatory limits apply to each frequency variant in specific countries, refer to Examples of regulatory limits on page 4-102:

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Registration of links

UK Registration of Links – OfCom, The application form may be found at:

http://www.ofcom.org.uk/radiocomms/isu

Eire Registration of Links – Commission for Communication Regulation, The application form may be found at:

http://www.comreg.ie/licensing_and_services

Regulatory issues with connectorized units

Maximum EIRP for connectorized units

In most regions (including USA, Canada, Europe and Australia) operation of products in the band 5470 MHz to 5725 MHz is constrained by an EIRP limit. The constraint is that the EIRP must not exceed (17 + 10 x Log Bandwidth) dBm.

In some regions (including Europe) operation of products in the band 5725 MHz to 5850/5875 MHz is constrained by an EIRP limit. The constraint is that the EIRP must not exceed (23 + 10 x Log Bandwidth) dBm.

As the PTP 54600 and PTP 58600 have an operating bandwidth from approximately 5 MHz to approximately 30 MHz, then the maximum allowed EIRP depends on the operating bandwidth of the radio as shown in Table 4-77.

Table 4-77 Normal EIRP limits with operating channel bandwidth

Operating bandwidth (MHz)	Allowed EIRP (dBm) at 5.4 GHz	Allowed EIRP (dBm) at 5.8 GHz
5	24	30
10	27	33
15	28.8	34.8
30	30	36

These EIRP limits apply in ETSI regions and FCC/IC regions at 5.4 GHz.

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Calculating EIRP for connectorized units

When operating with external antennas, the installer or operator has to set the maximum transmit power to ensure that the EIRP limit is not exceeded. The EIRP may be calculated from:

Allowed EIRP(dBm) =

Max_Transmit_Power (dBm) + Antenna Gain (dBi) – Feeder Losses (dB)

and hence:

Max_Transmit_Power (dBm) =

Allowed EIRP(dBm) – Antenna Gain (dBi) + Feeder Losses (dB)

The Set_Max_Transmit_Power parameter for connectorized units

As the actual maximum transmit power can only be adjusted in 1 dB steps, then the installer or operator must configure the PTP 54600 or PTP 58600 to have a Set_Max_Transmit_Power parameter as calculated below:

Set_Max_Transmit_Power = [Max_Transmit_Power] rounded down to nearest lower dB step

In order to simplify matters, the settings to be used for regions with the EIRP limits in Table 4-77 (assuming short feeder cables) are shown in Table 4-78.

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Table 4-78 Setting maximum transmit power to meet general EIRP limits

Antenna size	Maximum available antenna gain (dBi)	Operating bandwidth (MHz)	Set_Max_Transmit_Power parameter setting (dBm)	
			5.4 GHz	5.8 GHz
2ft dish	29.4	5	-6	0
		10	-3	3
		15	-2	4
		30	1	7
2.5ft dish	31.2	5	Not allowed	-2
		10	-5	1
		15	-3	3
		30	0	6
3ft dish	33.4	5	Not allowed	-4
		10	-7	-1
		15	-5	0
		30	-2	3
4ft dish	34.8	5	Not allowed	-6
		10	Not allowed	-3
		15	-7	-1
		30	-4	2

NOTE

Table 4-78 has been calculated on the basis of 0.5 dB cable loss and the highest gain antennas per size of which Motorola are aware. At these operating frequencies, feeder losses even with short cables are unlikely ever to be below 0.5 dB for practical installations and cable diameters.

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Cable losses (FCC regions only) for connectorized units

The FCC approval for the product is based on tests with a cable loss between the units of not less than 1.2 dB at 5.8 GHz. The use of lower cable losses would result in the installation being outside the FCC rules. As an indication, 1.2 dB of cable loss corresponds to the following cable lengths excluding connector losses (source: Times Microwave).

Table 4-79 Cable losses per length

Cable	Length for 1.2dB Cable Loss at 5.8 GHz	
	(ft)	(m)
LMR100	1.9	0.6
LMR200	4.6	1.4
LMR300	7.25	2.2
LMR400	11.1	3.4
LMR600	16.5	5.0

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Electromagnetic energy

Standards

Relevant standards (USA and EC) applicable when working with RF equipment are:

- *ANSI IEEE C95.1-1991, IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.*
- Council recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) (1999/519/EC) and respective national regulations.
- *Directive 2004/40/EC of the European Parliament and of the Council of 29 April 2004* on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (electromagnetic fields) (18th individual Directive within the meaning of Article 16(1) of Directive 89/391/EEC).
- US FCC limits for the general population. See the FCC web site at http://www.fcc.gov, and the policies, guidelines, and requirements in Part 1 of Title 47 of the Code of Federal Regulations, as well as the guidelines and suggestions for evaluating compliance in FCC OET Bulletin 65.
- Health Canada limits for the general population. See the Health Canada web site at http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/99ehd-dhm237/limits-limites_e.html and Safety Code 6.
- EN 50383:2002 Basic standard for the calculation and measurement of electromagnetic field strength and SAR related to human exposure from radio base stations and fixed terminal stations for wireless telecommunication systems (110 MHz - 40 GHz).
- BS EN 50385:2002 Product standard to demonstrate the compliances of radio base stations and fixed terminal stations for wireless telecommunication systems with the basic restrictions or the reference levels related to human exposure to radio frequency electromagnetic fields (110 MHz – 40 GHz) – general public.
- ICNIRP (International Commission on Non-Ionizing Radiation Protection) guidelines for the general public. See the ICNIRP web site at http://www.icnirp.de/ and Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic, and Electromagnetic Fields.

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Power density exposure limit

Install the radios for the PTP 600 family of PTP wireless solutions so as to provide and maintain the minimum separation distances from all persons.

The applicable power density exposure limit from the standards (see Electromagnetic energy on page 4-98) is:

10 W/m² for RF energy in the 2.4-, 5.2-, 5.4-, 5.8- and 5.9 GHz frequency bands.

Calculation of power density

NOTE

The following calculation is based on the ANSI IEEE C95.1-1991 method. as that provides a worst case analysis. Details of the assessment to EN50383:2002 can be provided, if required.

Peak power density in the far field of a radio frequency point source is calculated as follows:

$$S = \frac{P.G}{4\pi d^2}$$

Where:	Is:
S	power density in W/m^2
P	maximum average transmit power capability of the radio, in W
G	total Tx gain as a factor, converted from dB
d	distance from point source, in m

Rearranging terms to solve for distance yields:

$$d = \sqrt{\frac{P.G}{4\pi.S}}$$

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Calculated distances and power compliance margins

Table 4-80 shows calculated minimum separation distances, recommended distances and resulting margins for each frequency band and antenna combination. These are conservative distances that include compliance margins. At these and greater separation distances, the power density from the RF field is below generally accepted limits for the general population.

Explanation of terms used in Table 4-80:

Tx burst – maximum average transmit power in burst (Watt)

P – maximum average transmit power capability of the radio (Watt)

G – total transmit gain as a factor, converted from dB

S – power density (W/m^2)

d – minimum distance from point source (metres)

R – recommended distances (metres)

C – compliance margin

Table 4-80 Power compliance margins

Band	Antenna	Tx burst (W)	P (W)	G	S (W/m^2)	d (m)	R (m)	C
2.5 GHz	Integrated	0.25	0.2	63	10	0.32	2	6.0
4.5 GHz	Integrated	0.5	0.4	158	10	0.71	5	7.0
4.8 GHz	Integrated	0.5	0.4	158	10	0.71	5	7.0
	Connectorized	0.5	0.4	398	10	1.1	5	4.5
4.9 GHz	Integrated	0.25	0.2	158	10	0.5	2	4.0
	Connectorized	0.25	0.2	398	10	0.8	5	6.25
5.4 GHz	Integrated	0.005	0.004	200	10	0.08	1	12.5
	External 4ft Dish	0.00035	0.00028	2884	10	0.08		

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Band	Antenna	Tx burst (W)	P (W)	G	S (W/m^2)	d (m)	R (m)	C
5.8 GHz	Integrated	0.32	0.26	200	10	0.63	2	3.2
	External 2ft Flat Plate	0.32	0.26	631	10	1.0	5	5.0
	External 6ft Dish	0.32	0.26	6310	10	3.07	10	3.25
	External sectored antenna (60°)	0.32	0.26	50.1	10	0.28	1	3.6
5.9 GHz	Integrated	0.32	0.16	200	10	0.63	2	4.0
	External 2ft Flat Plate	0.32	0.16	631	10	1.0	5	5.0
	External 6ft Dish	0.32	0.16	6310	10	3.07	10	3.25

NOTE

Gain of antenna in dBi = 10*log(G).

The regulations require that the power used for the calculations is the maximum power in the transmit burst subject to allowance for source-based time-averaging.

At 5.4 GHz and EU 5.8 GHz, the products are generally limited to a fixed EIRP which can be achieved with the Integrated Antenna. The calculations above assume that the maximum EIRP allowed by the regulations is being transmitted.

NOTE

If there are no EIRP limits in the country of deployment, use the distance calculations for FCC 5.8 GHz for all frequency bands.

At FCC 5.8 GHz, for antennas between 0.6m (2ft) and 1.8m (6ft), alter the distance proportionally to the antenna gain.

At 2.5 GHz, for antennas between 1.2m (4ft) and 3.6m (12ft) the safe distance is increased to between 0.8m (2.6 ft) and 2.4m (7.8 ft).

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Examples of regulatory limits

These tables show how the regulatory limits currently apply in specific countries. Operators should note that regulations are subject to change.

Table 4-81 PTP 25600 examples of regulatory limits

Region	Examples of Regulatory Limits at 2.5 GHz
FCC	Under FCC Regulations, operation of this product is only allowed with a License Key for Region 16 which ensures that the product will meet the requirements of FCC part 27. Spectrum in this band (2496MHz to 2690MHz) is allocated on a licensed basis in USA.

Table 4-82 PTP 45600 examples of regulatory limits

Region	Examples of Regulatory Limits at 4.5 GHz
US Federal	Operation of this product is only allowed with a License Key for Region 23 (US Federal).
NTIA	Operation of this product is only allowed with a License Key for Region 24.

Table 4-83 PTP 48600 examples of regulatory limits

Region	Examples of Regulatory Limits at 5.4GHz
US Federal	Operation of this product is only allowed with a License Key for Regions 15 or 23 (US Federal).
NTIA	Operation of this product is only allowed with a License Key for Region 24.

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Table 4-84 PTP 49600 examples of regulatory limits

Region	Examples of Regulatory Limits at 5.4GHz
USA, Canada and Hong Kong Public Safety	Operation of this product is only allowed with a License Key for Region 14 (USA/Canada Public Safety) or Region 18 (Hong Kong Public Safety).

Table 4-85 PTP 54600 examples of regulatory limits

Region	Examples of Regulatory Limits at 5.4GHz
FCC	Operation of this product is only allowed with a License Key for Region 12. This implements Radar Detection and limits the EIRP to the regulatory limits below: EIRP ≤ Max of [(17 +10 x Log(Channel BW)) and 30] dBm.
ETSI	Operation of this product is only allowed with a License Key for Region 26. This implements Radar Detection, including barring of the band from 5600 MHz to 5650 MHz and limits the EIRP to the regulatory limits below: EIRP ≤ Max of [(17 +10 x Log(Channel BW)) and 30] dBm
Australia, Canada	Operation of this product is only allowed with a License Key for Region 13. This implements Radar Detection, including barring of the band from 5600 MHz to 5650 MHz and limits the EIRP to the regulatory limits below: EIRP ≤ Max of [(17 +10 x Log(Channel BW)) and 30] dBm
Thailand	Operation of this product is only allowed with a License Key for Region 20 (30 dBm or 1W EIRP)
Korea	Operation of this product is only allowed with a License Key for Region 21 (28 dBm EIRP (15 MHz), 27 dBm EIRP (10 MHz), 24 dBm EIRP (5 MHz)).

General Notice Applicable to Europe – 5.4 GHz
This equipment complies with the essential requirements for the EU R&E Directive 1999/5/EC.

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NOTE

In regions other than EU/USA, specific local regulations may apply. It is the responsibility of the installer/user to check that the equipment as deployed meets local regulatory requirements.

Table 4-86 PTP 58600 examples of regulatory limits

Region	Examples of Regulatory Limits at 5.8GHz
USA/ Canada/ Taiwan/ Brazil	Equipment can be operated in any mode, best results will be obtained using Region 1 settings. There are some limitations on the use of antennas above 4ft diameter plus a band edge power reduction.
China	Operation of this product is only allowed with a License Key for Region 2 (33 dBm or 2W EIRP).
Australia	Operation of this product is only allowed with a License Key for Region 3 (36 dBm or 4W EIRP).
Hong Kong	Operation of this product is only allowed with a License Key for Region 3 (36 dBm or 4W EIRP).
UK	Operation of this product is allowed with a License Key for Region 4. This implements Radar Detection with barring of the band from 5795 MHz to 5815 MHz and above 5850 MHz. It limits the EIRP to the Regulatory Limits below: EIRP ≤ Max of [(23 +10 x Log(Channel BW)) and 36] dBm
Singapore	Operation of this product is only allowed with a License Key for Region 5 (20 dBm or 100mW EIRP).
Eire	Operation of this product is only allowed with a License Key for Region 6 (33 dBm or 2W EIRP). The lower power limits are lower in narrower bandwidths.
Korea	Operation of this product is only allowed with a License Key for Region 11 (43 dBm or 20W EIRP).
India	Operation of this product is only allowed with a License Key for Region 19 (36 dBm or 4W EIRP at 15 MHz and 10 MHz and 33 dBm or 2 W EIRP at 5 MHz channel bandwidth).

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Region	Examples of Regulatory Limits at 5.8GHz
Thailand	Operation of this product is only allowed with a License Key for Region 20 (30 dBm or 1W EIRP).
Germany	Operation of this product is only allowed with a License Key for Region 22. This limits the band of operation to 5755 MHz to 5850 MHz and limits the EIRP to the Regulatory Limits below: EIRP ≤ Max of [(23 +10 x Log(Channel BW)) and 36] dBm
Bahrain	Operation of this product is allowed with a License Key for Region 24 . This limits the EIRP to the Regulatory Limits below: EIRP ≤ Max of [(20 +10 x Log(Channel BW)) and 33] dBm
Norway	Under Norway Regulations, operation of this product is only allowed with a License Key for Region 7. This implements Radar Detection and limits the EIRP to the Regulatory Limits below: EIRP ≤ Max of [(40 +10 x Log(Channel BW)) and 53] dBm Spectral density at border between Norway and neighboring countries shall not exceed -122,5 dBW/m2 measured with a reference bandwidth of 1 MHz.

General Notice Applicable to Europe – 5.8 GHz
This equipment complies with the essential requirements for the EU R&E Directive 1999/5/EC.
The use of 5.8GHz for Point to Point radio links is not harmonized across the EU and currently the product may only be deployed in the UK, Eire (IRL), Germany, Denmark and Norway.
However, the regulatory situation in Europe is changing and the radio spectrum may become available in other countries in the near future. Please contact Motorola for the latest situation.

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Table 4-87 PTP 59600 examples of regulatory limits

Region	Examples of Regulatory Limits at 5.9 GHz
Russia	Operation of this product is only allowed with a License Key for Region 16 (no power limit)
India	Operation of this product is only allowed with a License Key for Regions 17 or 19 (36 dBm or 4W EIRP at 30 MHz, 15 MHz and 10 MHz; and 33 dBm or 2 W EIRP at 5 MHz channel bandwidth).

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Notifications

PTP 25600 regulatory compliance

The PTP 25600 complies with the regulations that are in force in the USA. The relevant notifications are specified in this section.

U.S. Federal Communication Commission (FCC) notification

This device complies with Part 27 of the US FCC Rules and Regulations. Use of this product is limited to operators holding Licenses for the specific operating channels.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15E of the US FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio-frequency energy and, if not installed and used in accordance with these instructions, may cause harmful interference to radio communications. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment on and off, the user is encouraged to correct the interference by one or more of the following measures:

- Increase the separation between the affected equipment and the unit;
- Connect the affected equipment to a power outlet on a different circuit from that which the receiver is connected to;
- Consult the dealer and/or experienced radio/TV technician for help.
- FCC IDs Certification Numbers are listed below:



Where necessary, the end user is responsible for obtaining any National licenses required to operate this product and these must be obtained before using the product in any particular country. Contact the appropriate national administrations for details on the conditions of use for the bands in question and any exceptions that might apply.

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PTP 49600 regulatory compliance

The PTP 49600 complies with the regulations that are in force in the USA and Canada. The relevant notifications are specified in this section.

PTP 49600 FCC and IC notification

The system has been approved under FCC Part 90 and Industry Canada RSS-111 for Public Safety Agency usage. The installer or operator is responsible for obtaining the appropriate site licenses before installing or using the system.

FCC IDs and Industry Canada Certification Numbers are listed below:



IC:109A0-49100

PTP 54600 regulatory compliance

The PTP 54600 complies with the regulations that are in force in the USA, Canada and Europe. The relevant notifications are specified in this section.

PTP 54600 FCC and IC notification

U.S. Federal Communication Commission (FCC) and Industry Canada (IC) Notification.

This device complies with part 15.407 of the US FCC Rules and Regulations and with RSS-210 Issue 7 of Industry Canada. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation. In Canada, users should be cautioned to take note that high power radars are allocated as primary users (meaning they have priority) of 5250 – 5350 MHz and 5650 – 5850 MHz and these radars could cause interference and/or damage to license-exempt local area networks (LELAN).

For the connectorized version of the product and in order to reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (EIRP) is not more than that permitted by the regulations. The transmitted power must be reduced to achieve this requirement.

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This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the US FCC Rules and with RSS-210 of Industry Canada. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio-frequency energy and, if not installed and used in accordance with these instructions, may cause harmful interference to radio communications. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment on and off, the user is encouraged to correct the interference by one or more of the following measures:

- Increase the separation between the affected equipment and the unit;
- Connect the affected equipment to a power outlet on a different circuit from that which the receiver is connected to;
- Consult the dealer and/or experienced radio/TV technician for help.
- FCC IDs and Industry Canada Certification Numbers are listed below:



Where necessary, the end user is responsible for obtaining any National licenses required to operate this product and these must be obtained before using the product in any particular country. Contact the appropriate national administrations for details on the conditions of use for the bands in question and any exceptions that might apply.

PTP 54600 European Union notification

The PTP 54600 product is a two-way radio transceiver suitable for use in Broadband Wireless Access System (WAS), Radio Local Area Network (RLAN), or Fixed Wireless Access (FWA) systems. It is a Class 1 device and uses operating frequencies that are harmonized throughout the EU member states. The operator is responsible for obtaining any national licenses required to operate this product and these must be obtained before using the product in any particular country.

Hereby, Motorola declares that the PTP 54600 product complies with the essential requirements and other relevant provisions of Directive 1999/5/EC. The declaration of conformity may be consulted at http://www.motorola.com/ptp/support.

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This equipment is marked to show compliance with the European R&TTE directive



1999/5/EC.

European Union (EU) Waste of Electrical and Electronic Equipment (WEEE) directive The European Union's WEEE directive requires that products sold into EU countries must have the crossed out trash bin label on the product (or the package in some cases). As defined by the WEEE directive, this cross-out trash bin label means that customers and end-users in EU countries should not dispose of electronic and electrical equipment or accessories in household waste. Customers or end-users in EU countries should contact their local equipment supplier representative or service center for information about the waste collection system in their country.

PTP 58600 regulatory compliance

The PTP 58600 complies with the regulations that are in force in the USA, Canada and Europe. The relevant notifications are specified in this section.

PTP 58600 FCC and IC notification

U.S. Federal Communication Commission (FCC) and Industry Canada (IC) Notification.

This system has achieved Type Approval in various countries around the world. This means that the system has been tested against various local technical regulations and found to comply. The frequency band in which the system operates is ‘license exempt’ and the system is allowed to be used provided it does not cause interference. Further, the licensing authority does not guaranteed protection against interference from other products and installations.

This device complies with part 15 of the US FCC Rules and Regulations and with RSS-210 of Industry Canada. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation. In Canada, users should be cautioned to take note that high power radars are allocated as primary users (meaning they have priority) of the 5650 – 5850 MHz spectrum and these radars could cause interference and/or damage to license-exempt local area networks (LELAN).

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For the connectorized version of the product and in order to reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the Effective Isotropically Radiated Power (EIRP) is not more than that permitted for successful communication.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the US FCC Rules and with RSS-210 of Industry Canada. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio-frequency energy and, if not installed and used in accordance with these instructions, may cause harmful interference to radio communications. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment on and off, the user is encouraged to correct the interference by one or more of the following measures:

- Increase the separation between the affected equipment and the unit;
- Connect the affected equipment to a power outlet on a different circuit from that which the receiver is connected to;
- Consult the dealer and/or experienced radio/TV technician for help.

FCC IDs and Industry Canada Certification Numbers are listed below:



Where necessary, the end user is responsible for obtaining any National licenses required to operate this product and these must be obtained before using the product in any particular country. Contact the appropriate national administrations for details on the conditions of use for the bands in question and any exceptions that might apply.

PTP 58600 European Union notification

The PTP 58600 is a Class 2 device as it operates on frequencies that are not harmonized across the EU. Currently the product may only be operated in the UK, Eire (IRL), Germany, Norway and Denmark. However, the regulatory situation in Europe is changing and the radio spectrum may become available in other countries in future. See www.ero.dk for further information. The operator is responsible for obtaining any national licenses required to operate this product and these must be obtained before using the product in any particular country.

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Hereby, Motorola declares that the PTP 58600 product complies with the essential requirements and other relevant provisions of Directive 1999/5/EC. The declaration of conformity may be consulted at http://www.motorola.com/ptp/support.

This equipment is marked to show compliance with the European R&TTE directive 1999/5/EC.

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European Union (EU) Waste of Electrical and Electronic Equipment (WEEE) directive:

The European Union's WEEE directive requires that products sold into EU countries must have the crossed out trash bin label on the product (or the package in some cases). As defined by the WEEE directive, this cross-out trash bin label means that customers and end-users in EU countries should not dispose of electronic and electrical equipment or accessories in household waste. Customers or end-users in EU countries should contact their local equipment supplier representative or service center for information about the waste collection system in their country.

UK notification

The PTP 58600 connectorized product has been notified for operation in the UK, and when operated in accordance with instructions for use it is compliant with UK Interface Requirement IR2007. For UK use, installations must conform to the requirements of IR2007 in terms of EIRP spectral density against elevation profile above the local horizon in order to protect Fixed Satellite Services. The frequency range 5795-5815 MHz is assigned to Road Transport & Traffic Telematics (RTTT) in the U.K. and shall not be used by FWA systems in order to protect RTTT devices. UK Interface Requirement IR2007 specifies that radiolocation services shall be protected by a Dynamic Frequency Selection (DFS) mechanism to prevent co-channel operation in the presence of radar signals.

⚠ CAUTION

This equipment operates as a secondary application, so it has no rights against harmful interference, even if generated by similar equipment, and must not cause harmful interference on systems operating as primary applications.

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PTP 59600 regulatory compliance

Russia

This system has been tested for type approval in Russia of fixed link equipment under the heading of BPD TZS 12.

Сертификат соответствия	Срок действия
ОС-1-РД-0241	с 28 октября 2008 г.

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Data rate calculations

This section provides instructions, tables and graphs to allow calculation of the data rate capacity that can be provided by alternative PTP 600 configurations.

The following topics are described in this section:

- Data rate defined on page 4-114
- Calculation procedure and example on page 4-115
- Data throughput capacity on page 4-117
- Range adjustment curves on page 4-128

Data rate defined

The data rate capacity of a PTP link is defined as the maximum end-to-end Ethernet throughput (including Ethernet headers) that it can support. It is assumed that Ethernet frames are 1500 octet. Data rate capacity is determined by the following factors:

- Product variant (PTP 600 Full or Lite)
- Link Symmetry
- Link Mode Optimization (IP or TDM)
- Modulation Mode
- Channel Bandwidth
- Link Range

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Calculation procedure and example

Procedure

To calculate the data rate capacity of a PTP 600 link, perform Procedure 4-1.

Procedure 4-1 Calculating data rate capacity

1	Use the tables in Data throughput capacity on page 4-117 to look up the data throughput capacity rates (Tx, Rx and Both) for the required combination of: Link Symmetry Link Mode Optimization Modulation Mode Channel Bandwidth
2	The tables contain data rates for PTP 600 Full only. If the ODUs are PTP 600 Lite, divide the data rates by 2.
3	The tables contain data rates for links of zero range. Use the curves in Range adjustment curves on page 4-128 to look up the Throughput Factor that must be applied to adjust the data rates for the actual range of the link.
4	Multiply the data rates by the Throughput Factor to give the throughput capacity of the link.

NOTE

There is a small difference between the rates for IP and TDM because there is fragmentation in TDM (for low priority traffic) which causes the throughput to be reduced buy approximately 1% compared to the IP mode.

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Example

Suppose that the link characteristics are:

- Product variant = PTP 600 Lite
- Link Symmetry = 1:1
- Link Mode Optimization = TDM
- Modulation Mode = 64QAM 0.92 Dual
- Channel Bandwidth = 10 MHz
- Link Range = 60 km

The calculation procedure for this example is described in Procedure 4-2.

Procedure 4-2 Example of data rate capacity calculation

1	Use Table 4-89 to look up the data throughput capacity rates: • Tx = 41.41 Mbits/s • Rx = 41.41 Mbits/s • Both = 82.81 Mbits/s
2	Divide these rates by 2 to give PTP 600 Lite rates: • Tx = 20.70 Mbits/s • Rx = 20.70 Mbits/s • Both = 41.40 Mbits/s
3	Use Figure 4-39 to look up the Throughput Factor for 1:1, TDM and Link Range 60 km. The factor is 0.86.
4	Multiply the rates from Step 2 by the Throughput Factor from Step 3 to give the throughput capacity of the link: • Tx = 17.80 Mbits/s • Rx = 17.80 Mbits/s • Both = 35.60 Mbits/s

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Data throughput capacity

Table 4-88, Table 4-89, Table 4-90, Table 4-91 and Table 4-92 show the data throughput rates (Mbits/s) that are achieved when two PTP 600 Full ODUs are linked and the link distance (range) is 0 km. Use the curves in Range adjustment curves on page 4-128 to adjust these figures to allow for link range.

NOTE

When using these tables, be aware of the factors that affect data throughput, as listed below.

Data throughput capacity is restricted by the following factors:

- PTP 600 Lite data rates are half the PTP 600 Full rates given in this section.
- Modulation Mode “256QAM 0.81 dual” is not available in all product variants and channel bandwidths.
- Throughput for Link Symmetry 2:1 is the same as that for 1:2, but the Tx and Rx data rates are swapped.
- The data rates for Adaptive symmetry apply to the most asymmetric case where the link has significant offered traffic in one direction only. The data rates for Adaptive symmetry with bidirectional offered traffic are the same as those for Link Symmetry = 1:1 with Link Optimization = IP.

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Table 4-88 Throughput for PTP 600 Full, link symmetry 1:1, link optimization IP

Modulation Mode	30 MHz			20 MHz			15 MHz		
	Tx	Rx	Both	Tx	Rx	Both	Tx	Rx	Both
256QAM 0.81 dual	150.01	150.01	300.02	100.06	100.06	200.12	75.37	75.37	150.74
64QAM 0.92 dual	126.39	126.39	252.78	84.30	84.30	168.61	63.50	63.50	127.01
64QAM 0.75 dual	103.28	103.28	206.57	68.89	68.89	137.78	51.89	51.89	103.79
16QAM 0.87 dual	80.35	80.35	160.70	53.60	53.60	107.19	40.37	40.37	80.74
16QAM 0.63 dual	57.76	57.76	115.52	38.53	38.53	77.06	29.02	29.02	58.04
256QAM 0.81 single	75.00	75.00	150.01	50.03	50.03	100.06	37.69	37.69	75.37
64QAM 0.92 single	63.19	63.19	126.39	42.15	42.15	84.30	31.75	31.75	63.50
64QAM 0.75 single	51.64	51.64	103.28	34.45	34.45	68.89	25.95	25.95	51.89
16QAM 0.87 single	40.17	40.17	80.35	26.80	26.80	53.59	20.18	20.18	40.37
16QAM 0.63 single	28.88	28.88	57.76	19.26	19.26	38.53	14.51	14.51	29.02
QPSK 0.87 single	20.09	20.09	40.17	13.40	13.40	26.79	10.09	10.09	20.18
QPSK 0.63 single	14.44	14.44	28.88	9.63	9.63	19.26	7.25	7.25	14.51
BPSK 0.63 single	7.22	7.22	14.44	4.81	4.81	9.63	3.63	3.63	7.25

At zero range. All rates are in Mbit/s.

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Table 4-88 **Throughput for PTP 600 Full, link symmetry 1:1, link optimization IP** (continued)

Modulation Mode	10 MHz			5 MHz		
	Tx	Rx	Both	Tx	Rx	Both
256QAM 0.81 dual	50.11	50.11	100.21	24.22	24.22	48.43
64QAM 0.92 dual	42.22	42.22	84.43	20.40	20.40	40.80
64QAM 0.75 dual	34.50	34.50	69.00	16.67	16.67	33.34
16QAM 0.87 dual	26.84	26.84	53.68	12.97	12.97	25.94
16QAM 0.63 dual	19.29	19.29	38.59	9.32	9.32	18.65
256QAM 0.81 single	25.05	25.05	50.11	12.11	12.11	24.21
64QAM 0.92 single	21.11	21.11	42.21	10.20	10.20	20.40
64QAM 0.75 single	17.25	17.25	34.50	8.34	8.34	16.67
16QAM 0.87 single	13.42	13.42	26.84	6.48	6.48	12.97
16QAM 0.63 single	9.65	9.65	19.29	4.66	4.66	9.32
QPSK 0.87 single	6.71	6.71	13.42	3.24	3.24	6.48
QPSK 0.63 single	4.82	4.82	9.64	2.33	2.33	4.66
BPSK 0.63 single	2.41	2.41	4.82	1.16	1.16	2.33

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Table 4-89 Throughput for PTP 600 Full, link symmetry 1:1, link optimization TDM

Modulation Mode	30 MHz			20 MHz			15 MHz		
	Tx	Rx	Both	Tx	Rx	Both	Tx	Rx	Both
256QAM 0.81 dual	140.87	140.87	281.74	96.01	96.01	192.02	72.92	72.92	145.83
64QAM 0.92 dual	118.69	118.69	237.38	80.89	80.89	161.78	61.43	61.43	122.87
64QAM 0.75 dual	96.99	96.99	193.98	66.10	66.10	132.21	50.20	50.20	100.41
16QAM 0.87 dual	75.45	75.45	150.91	51.43	51.43	102.85	39.06	39.06	78.11
16QAM 0.63 dual	54.24	54.24	108.48	36.97	36.97	73.94	28.08	28.08	56.15
256QAM 0.81 single	70.43	70.43	140.87	48.00	48.00	96.01	36.46	36.46	72.91
64QAM 0.92 single	59.34	59.34	118.69	40.44	40.44	80.89	30.72	30.72	61.43
64QAM 0.75 single	48.49	48.49	96.99	33.05	33.05	66.10	25.10	25.10	50.20
16QAM 0.87 single	37.73	37.73	75.45	25.71	25.71	51.42	19.53	19.53	39.05
16QAM 0.63 single	27.12	27.12	54.24	18.48	18.48	36.97	14.04	14.04	28.07
QPSK 0.87 single	18.86	18.86	37.72	12.85	12.85	25.71	9.76	9.76	19.52
QPSK 0.63 single	13.56	13.56	27.12	9.24	9.24	18.48	7.02	7.02	14.03
BPSK 0.63 single	6.78	6.78	13.56	4.62	4.62	9.24	3.51	3.51	7.02

At zero range. All rates are in Mbit/s.

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Table 4-89 **Throughput for PTP 600 Full, link symmetry 1:1, link optimization TDM** (continued)

Modulation Mode	10 MHz			5 MHz		
	Tx	Rx	Both	Tx	Rx	Both
256QAM 0.81 dual	49.14	49.14	98.29	24.22	24.22	48.43
64QAM 0.92 dual	41.41	41.41	82.81	20.40	20.40	40.80
64QAM 0.75 dual	33.84	33.84	67.67	16.67	16.67	33.34
16QAM 0.87 dual	26.32	26.32	52.64	12.97	12.97	25.94
16QAM 0.63 dual	18.92	18.92	37.84	9.32	9.32	18.65
256QAM 0.81 single	24.57	24.57	49.14	12.11	12.11	24.21
64QAM 0.92 single	20.70	20.70	41.40	10.20	10.20	20.40
64QAM 0.75 single	16.92	16.92	33.83	8.34	8.34	16.67
16QAM 0.87 single	13.16	13.16	26.32	6.48	6.48	12.97
16QAM 0.63 single	9.46	9.46	18.92	4.66	4.66	9.32
QPSK 0.87 single	6.58	6.58	13.16	3.24	3.24	6.48
QPSK 0.63 single	4.73	4.73	9.46	2.33	2.33	4.66
BPSK 0.63 single	2.36	2.36	4.73	1.16	1.16	2.33

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Table 4-90 Throughput for PTP 600 Full, link symmetry 2:1, link optimization = IP

Modulation Mode	30 MHz			20 MHz			15 MHz		
	Tx	Rx	Both	Tx	Rx	Both	Tx	Rx	Both
256QAM 0.81 dual	198.58	99.29	297.88	133.42	66.71	200.12	100.50	50.25	150.74
64QAM 0.92 dual	167.31	83.66	250.97	112.41	56.20	168.61	84.67	42.33	127.01
64QAM 0.75 dual	136.73	68.36	205.09	91.86	45.93	137.78	69.19	34.59	103.79
16QAM 0.87 dual	106.37	53.18	159.55	71.46	35.73	107.19	53.83	26.91	80.74
16QAM 0.63 dual	76.47	38.23	114.70	51.37	25.68	77.06	38.70	19.35	58.04
256QAM 0.81 single	99.29	49.64	148.94	66.71	33.35	100.06	50.25	25.12	75.37
64QAM 0.92 single	83.66	41.83	125.48	56.20	28.10	84.30	42.33	21.17	63.50
64QAM 0.75 single	68.36	34.18	102.54	45.93	22.96	68.89	34.59	17.30	51.89
16QAM 0.87 single	53.18	26.59	79.77	35.73	17.86	53.59	26.91	13.46	40.37
16QAM 0.63 single	38.23	19.11	57.35	25.68	12.84	38.53	19.35	9.67	29.02
QPSK 0.87 single	26.59	13.29	39.88	17.86	8.93	26.79	13.46	6.73	20.18
QPSK 0.63 single	19.11	9.56	28.67	12.84	6.42	19.26	9.67	4.84	14.51
BPSK 0.63 single	9.56	4.78	14.33	6.42	3.21	9.63	4.84	2.42	7.25

At zero range. All rates are in Mbit/s.

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Table 4-90 **Throughput for PTP 600 Full, link symmetry 2:1, link optimization = IP** (continued)

Modulation Mode	10 MHz		
	Tx	Rx	Both
256QAM 0.81 dual	66.38	33.19	99.56
64QAM 0.92 dual	55.92	27.96	83.88
64QAM 0.75 dual	45.70	22.85	68.55
16QAM 0.87 dual	35.55	17.78	53.33
16QAM 0.63 dual	25.56	12.78	38.34
256QAM 0.81 single	33.19	16.59	49.78
64QAM 0.92 single	27.96	13.98	41.94
64QAM 0.75 single	22.85	11.42	34.27
16QAM 0.87 single	17.78	8.89	26.66
16QAM 0.63 single	12.78	6.39	19.17
QPSK 0.87 single	8.89	4.44	13.33
QPSK 0.63 single	6.39	3.19	9.58
BPSK 0.63 single	3.19	1.60	4.79

This combination is not available with Channel Bandwidth 5 MHz.

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Table 4-91 Throughput for PTP 600 Full, link symmetry 2:1, link optimization = TDM

Modulation Mode	30 MHz			20 MHz			15 MHz		
	Tx	Rx	Both	Tx	Rx	Both	Tx	Rx	Both
256QAM 0.81 dual	193.06	96.53	289.58	130.66	65.33	195.99	98.83	49.42	148.25
64QAM 0.92 dual	162.66	81.33	243.98	110.08	55.04	165.13	83.27	41.63	124.90
64QAM 0.75 dual	132.92	66.46	199.38	89.96	44.98	134.94	68.05	34.02	102.07
16QAM 0.87 dual	103.41	51.70	155.11	69.98	34.99	104.98	52.94	26.47	79.40
16QAM 0.63 dual	74.34	37.17	111.50	50.31	25.15	75.46	38.05	19.03	57.08
256QAM 0.81 single	96.53	48.26	144.79	65.33	32.66	97.99	49.42	24.71	74.12
64QAM 0.92 single	81.33	40.66	121.99	55.04	27.52	82.56	41.63	20.82	62.45
64QAM 0.75 single	66.46	33.23	99.69	44.98	22.49	67.47	34.02	17.01	51.03
16QAM 0.87 single	51.70	25.85	77.55	34.99	17.49	52.49	26.47	13.23	39.70
16QAM 0.63 single	37.17	18.58	55.75	25.15	12.58	37.73	19.03	9.51	28.54
QPSK 0.87 single	25.85	12.92	38.77	17.49	8.75	26.24	13.23	6.62	19.85
QPSK 0.63 single	18.58	9.29	27.87	12.58	6.29	18.86	9.51	4.76	14.27
BPSK 0.63 single	9.29	4.64	13.93	6.29	3.14	9.43	4.76	2.38	7.13

At zero range. All rates are in Mbit/s.

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Table 4-91 **Throughput for PTP 600 Full, link symmetry 2:1, link optimization = TDM**

(continued)

Modulation Mode	10 MHz		
	Tx	Rx	Both
256QAM 0.81 dual	66.38	33.19	99.56
64QAM 0.92 dual	55.92	27.96	83.88
64QAM 0.75 dual	45.70	22.85	68.55
16QAM 0.87 dual	35.55	17.78	53.33
16QAM 0.63 dual	25.56	12.78	38.34
256QAM 0.81 single	33.19	16.59	49.78
64QAM 0.92 single	27.96	13.98	41.94
64QAM 0.75 single	22.85	11.42	34.27
16QAM 0.87 single	17.78	8.89	26.66
16QAM 0.63 single	12.78	6.39	19.17
QPSK 0.87 single	8.89	4.44	13.33
QPSK 0.63 single	6.39	3.19	9.58
BPSK 0.63 single	3.19	1.60	4.79

This combination is not available with Channel Bandwidth 5 MHz.

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Table 4-92 Throughput for PTP 600 Full, link symmetry Adaptive, link optimization = IP

Modulation Mode	30 MHz			20 MHz			15 MHz		
	Tx	Rx	Both	Tx	Rx	Both	Tx	Rx	Both
256QAM 0.81 dual	236.95	59.23	296.18	148.53	49.51	198.03	112.12	37.37	149.49
64QAM 0.92 dual	199.63	49.91	249.54	125.14	41.71	166.85	94.46	31.49	125.95
64QAM 0.75 dual	163.14	40.78	203.92	102.26	34.09	136.35	77.19	25.73	102.92
16QAM 0.87 dual	126.91	31.73	158.64	79.55	26.52	106.07	60.05	20.02	80.07
16QAM 0.63 dual	91.24	22.81	114.04	57.19	19.06	76.25	43.17	14.39	57.56
256QAM 0.81 single	118.47	29.62	148.09	74.26	24.75	99.02	56.06	18.68	74.74
64QAM 0.92 single	99.82	24.95	124.77	62.57	20.85	83.42	47.23	15.74	62.97
64QAM 0.75 single	81.57	20.39	101.96	51.13	17.04	68.17	38.59	12.86	51.46
16QAM 0.87 single	63.46	15.86	79.32	39.78	13.26	53.03	30.02	10.01	40.03
16QAM 0.63 single	45.62	11.40	57.02	28.59	9.53	38.12	21.58	7.19	28.78
QPSK 0.87 single	31.73	7.93	39.66	19.89	6.63	26.51	15.01	5.00	20.01
QPSK 0.63 single	22.81	5.70	28.51	14.30	4.76	19.06	10.79	3.60	14.39
BPSK 0.63 single	11.40	2.85	14.25	7.15	2.38	9.53	5.39	1.80	7.19

At zero range. All rates are in Mbit/s.

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Table 4-92 Throughput for PTP 600 Full, link symmetry Adaptive, link optimization = IP (continued)

Modulation Mode	10 MHz		
	Tx	Rx	Both
256QAM 0.81 dual	66.38	33.19	99.56
64QAM 0.92 dual	55.92	27.96	83.88
64QAM 0.75 dual	45.70	22.85	68.55
16QAM 0.87 dual	35.55	17.78	53.33
16QAM 0.63 dual	25.56	12.78	38.34
256QAM 0.81 single	33.19	16.59	49.78
64QAM 0.92 single	27.96	13.98	41.94
64QAM 0.75 single	22.85	11.42	34.27
16QAM 0.87 single	17.78	8.89	26.66
16QAM 0.63 single	12.78	6.39	19.17
QPSK 0.87 single	8.89	4.44	13.33
QPSK 0.63 single	6.39	3.19	9.58
BPSK 0.63 single	3.19	1.60	4.79

This combination is not available with Channel Bandwidth 5 MHz.

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Range adjustment curves

Use these curves to look up the link Range and find the Throughput Factor that must be applied to adjust the 0 km data throughput rates for the required combination of Channel Bandwidth, Link Symmetry, Link Optimization, DFS and Link Range (km).

Table 4-93 Range adjustment characteristics

Channel Band-width	Link Sym-metry	Link Optimization	DFS	Range Adjustment Curve	See Figure
30 MHz	1:1	IP		A	Figure 4-31
		TDM		B	Figure 4-32
	2:1	IP		C	Figure 4-33
		TDM		D	Figure 4-34
	Adaptive	IP		E	Figure 4-35
20 MHz	1:1	IP		L	Figure 4-40
		TDM		N	Figure 4-41
	2:1	IP		L	Figure 4-40
		TDM		O	Figure 4-42
	Adaptive	IP		C	Figure 4-33
15 MHz	1:1	IP		F	Figure 4-36
		TDM		G	Figure 4-37
	2:1	IP	None	F	Figure 4-36
			FCC or ETSI	C	Figure 4-33
		TDM	None	H	Figure 4-38
			FCC or ETSI	C	Figure 4-33
	Adaptive	IP		A	Figure 4-31
10 MHz	1:1	IP		F	Figure 4-36

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Channel Band-width	Link Sym-metry	Link Optimization	DFS	Range Adjustment Curve	See Figure
		TDM		K	Figure 4-39
	2:1	IP		L	Figure 4-40
		TDM		L	Figure 4-40
	Adaptive	IP		L	Figure 4-40
5 MHz	1:1	IP, TDM		C	Figure 4-33

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Figure 4-31 PTP 600 range adjustment for data rates, curve A

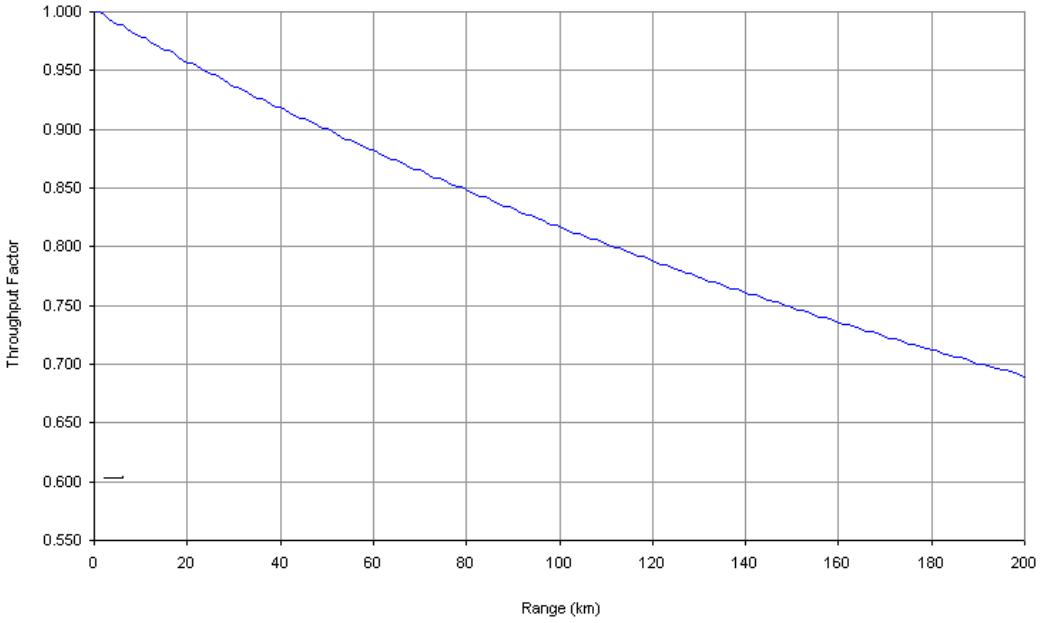
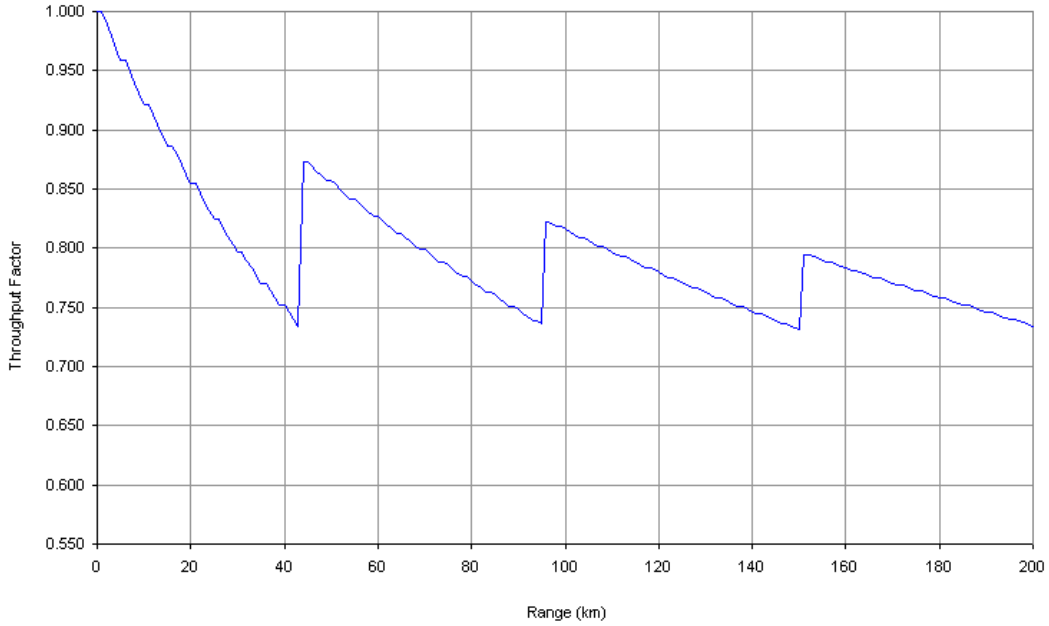


Figure 4-32 PTP 600 range adjustment for data rates, curve B



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Figure 4-33 PTP 600 range adjustment for data rates, curve C

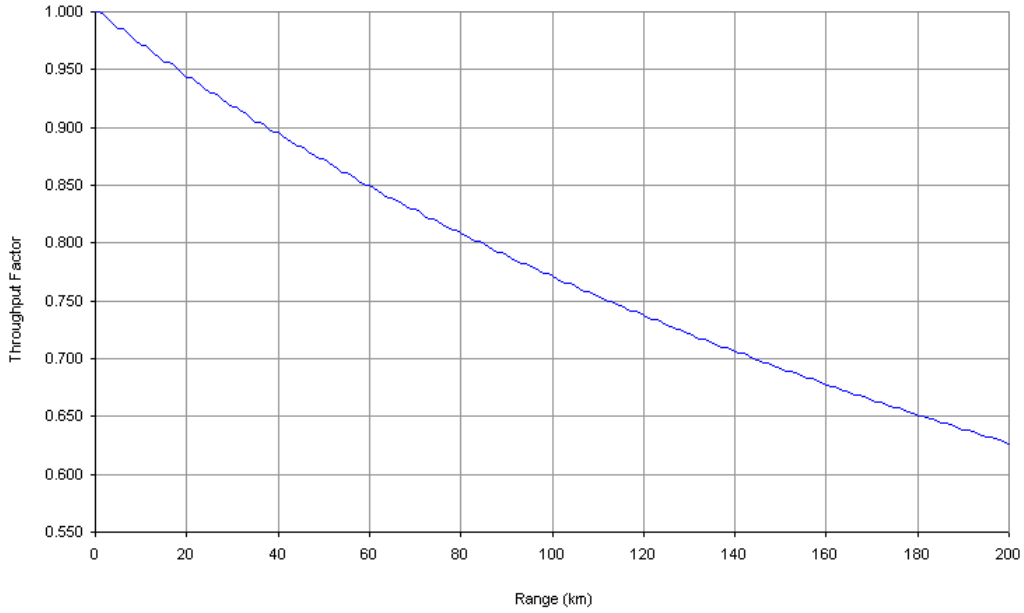
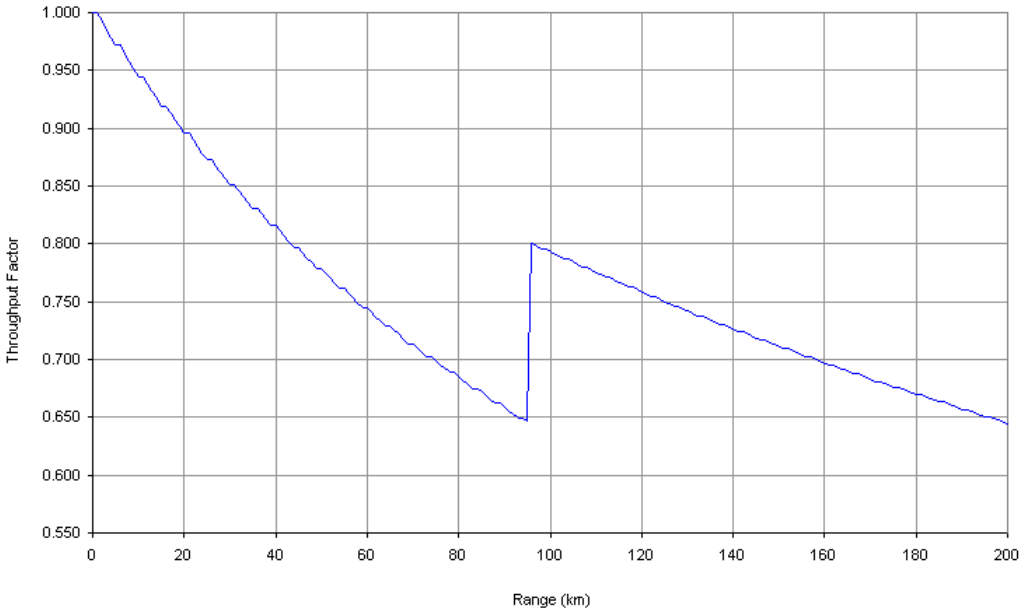


Figure 4-34 PTP 600 range adjustment for data rates, curve D



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Figure 4-35 PTP 600 range adjustment for data rates, curve E

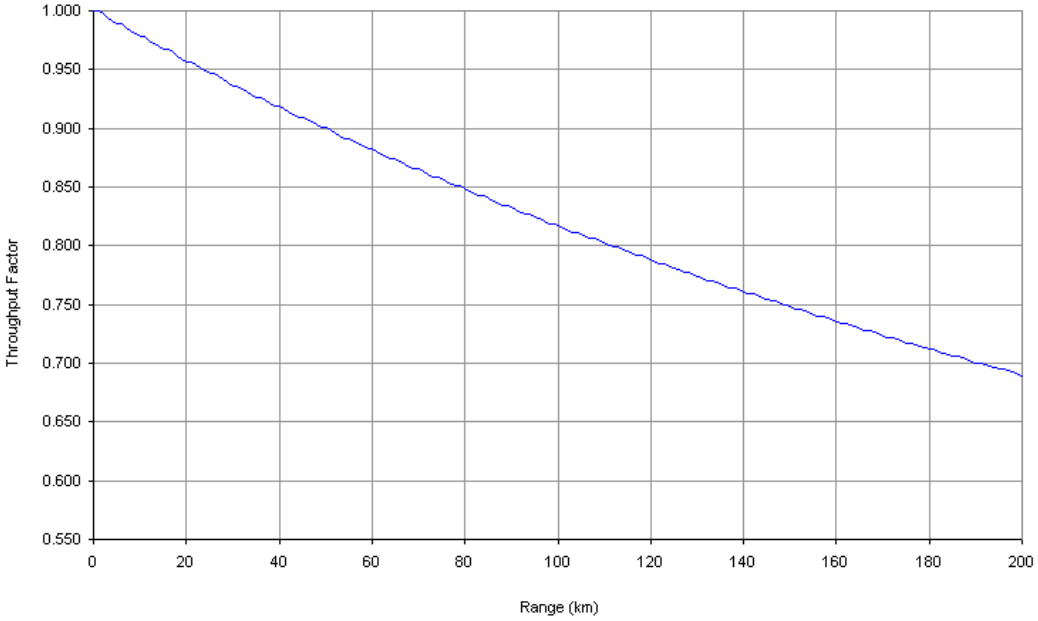
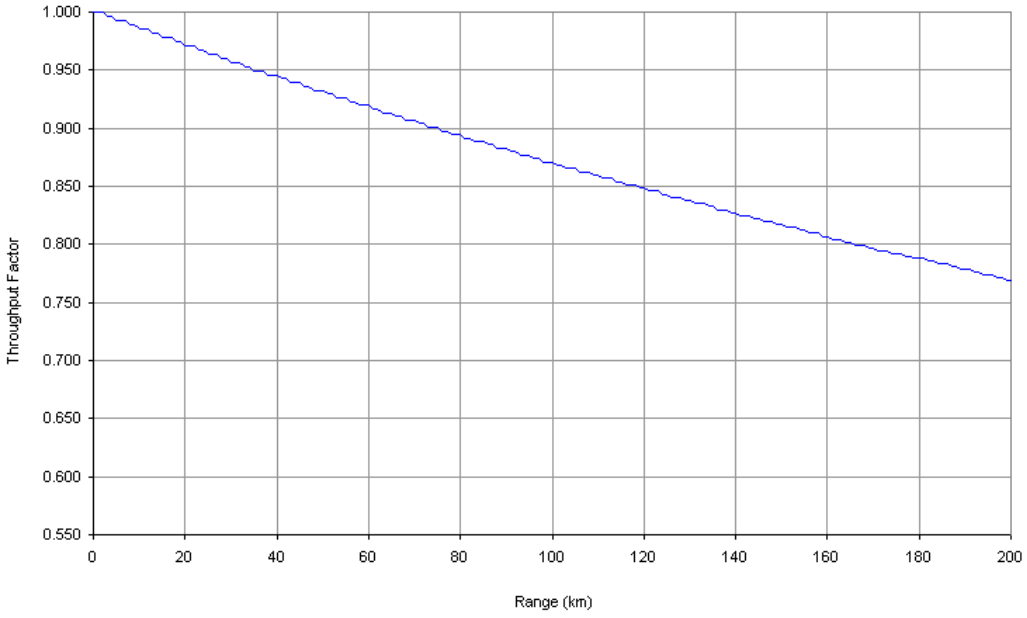


Figure 4-36 PTP 600 range adjustment for data rates, curve F



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Figure 4-37 PTP 600 range adjustment for data rates, curve G

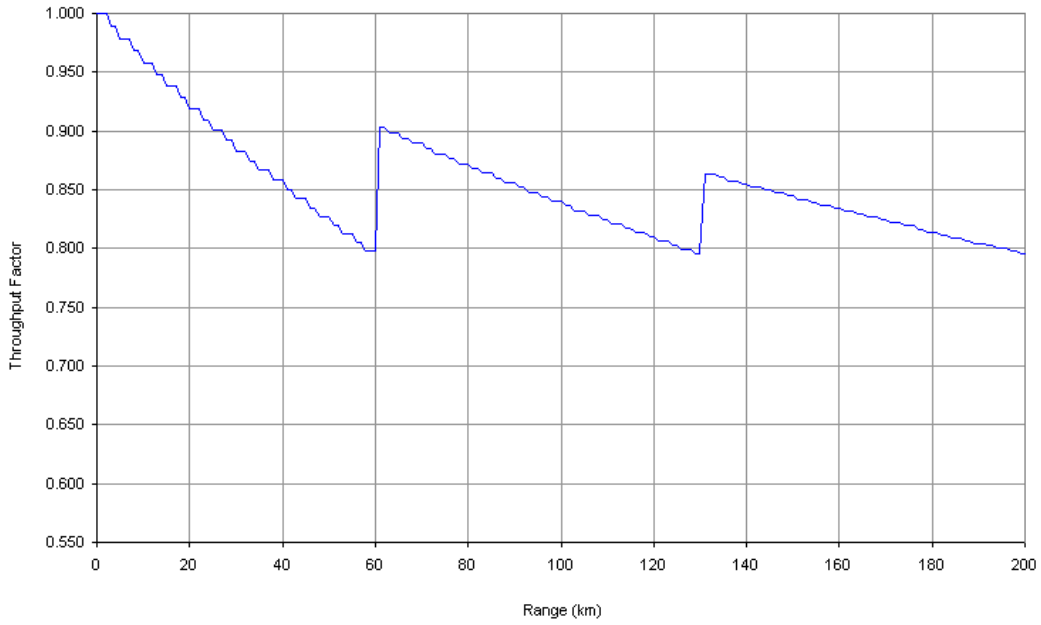
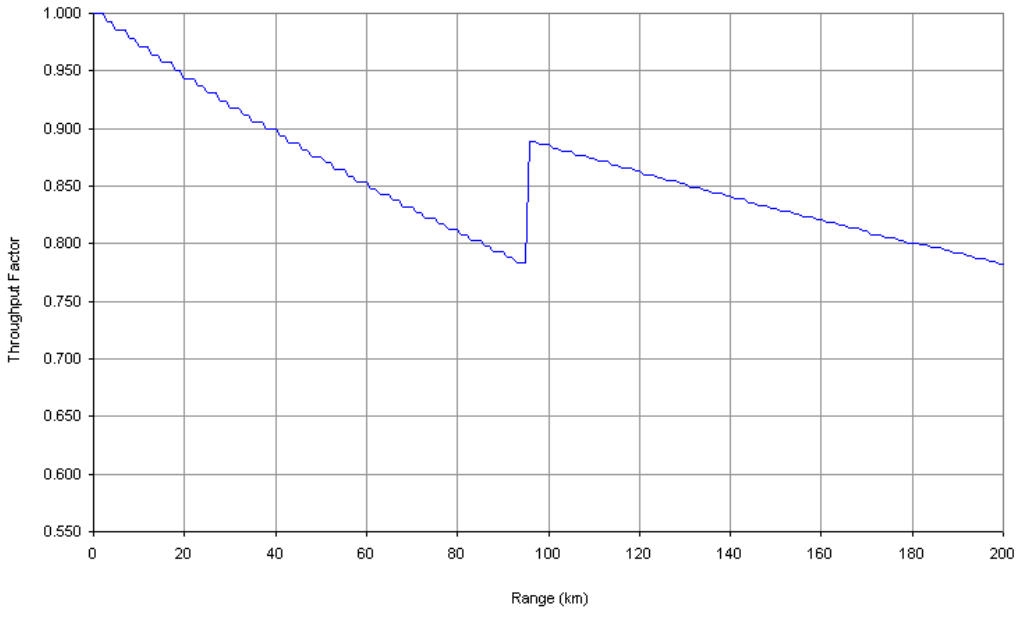


Figure 4-38 PTP 600 range adjustment for data rates, curve H



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Figure 4-39 PTP 600 range adjustment for data rates, curve K

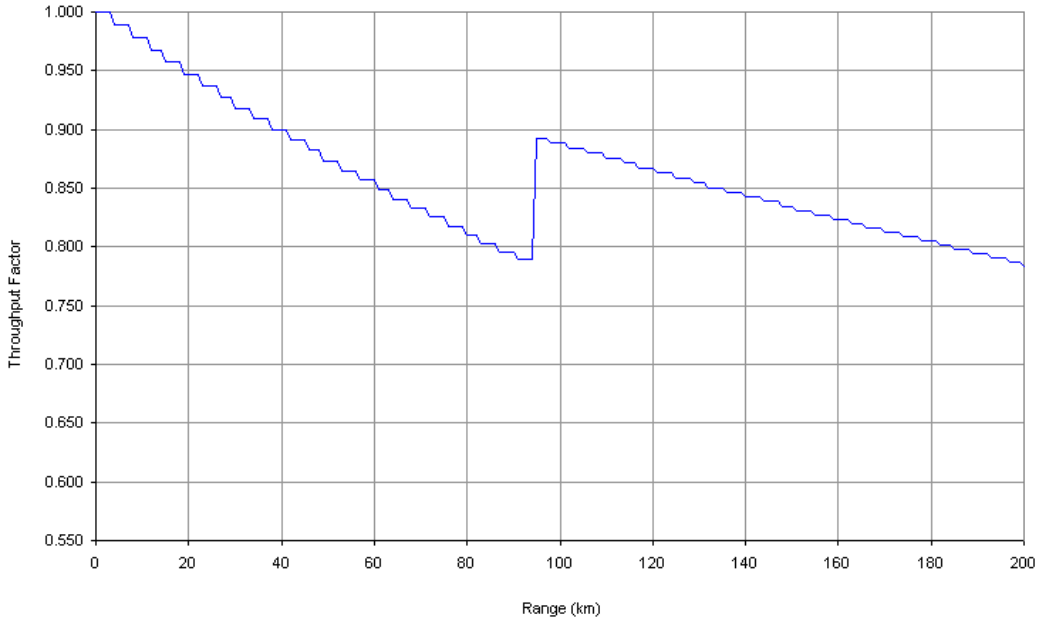
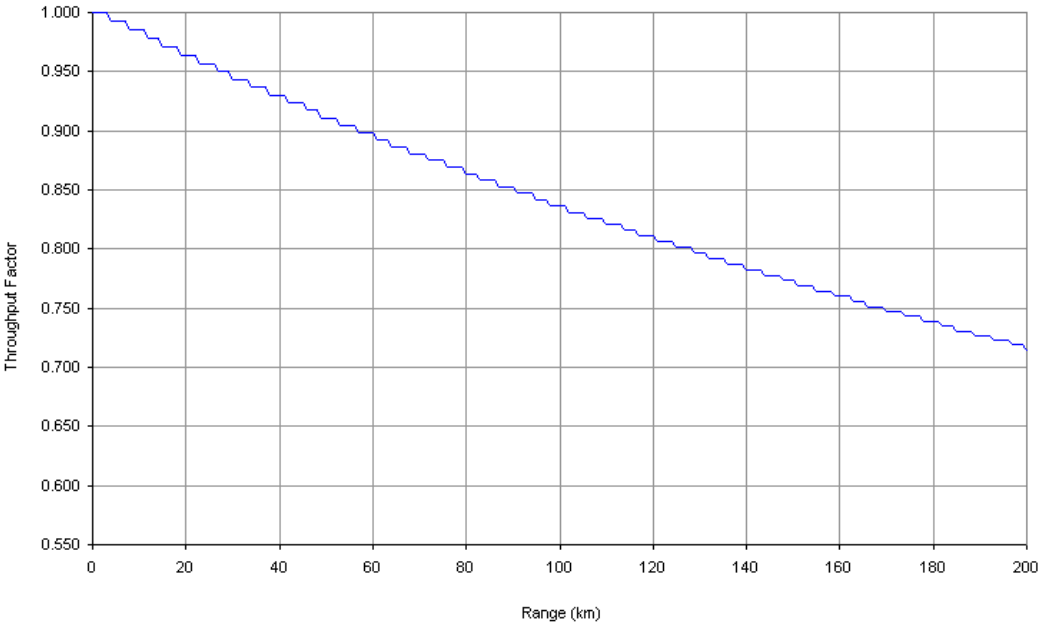
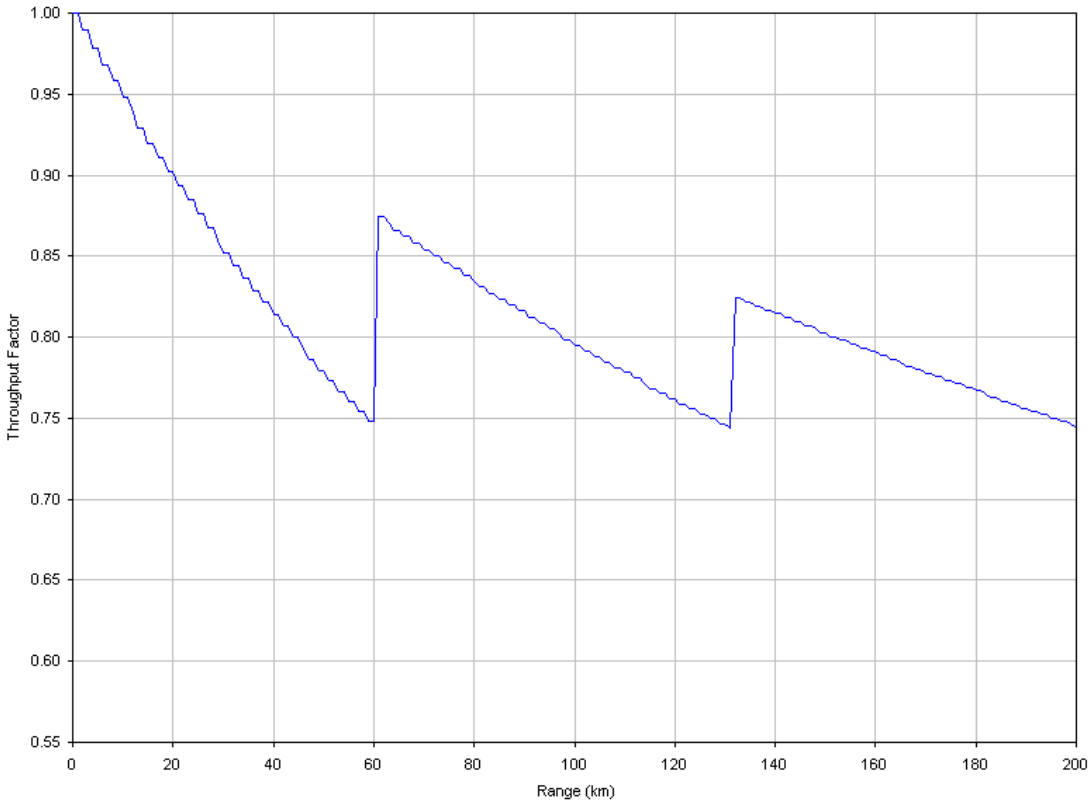


Figure 4-40 PTP 600 range adjustment for data rates, curve L



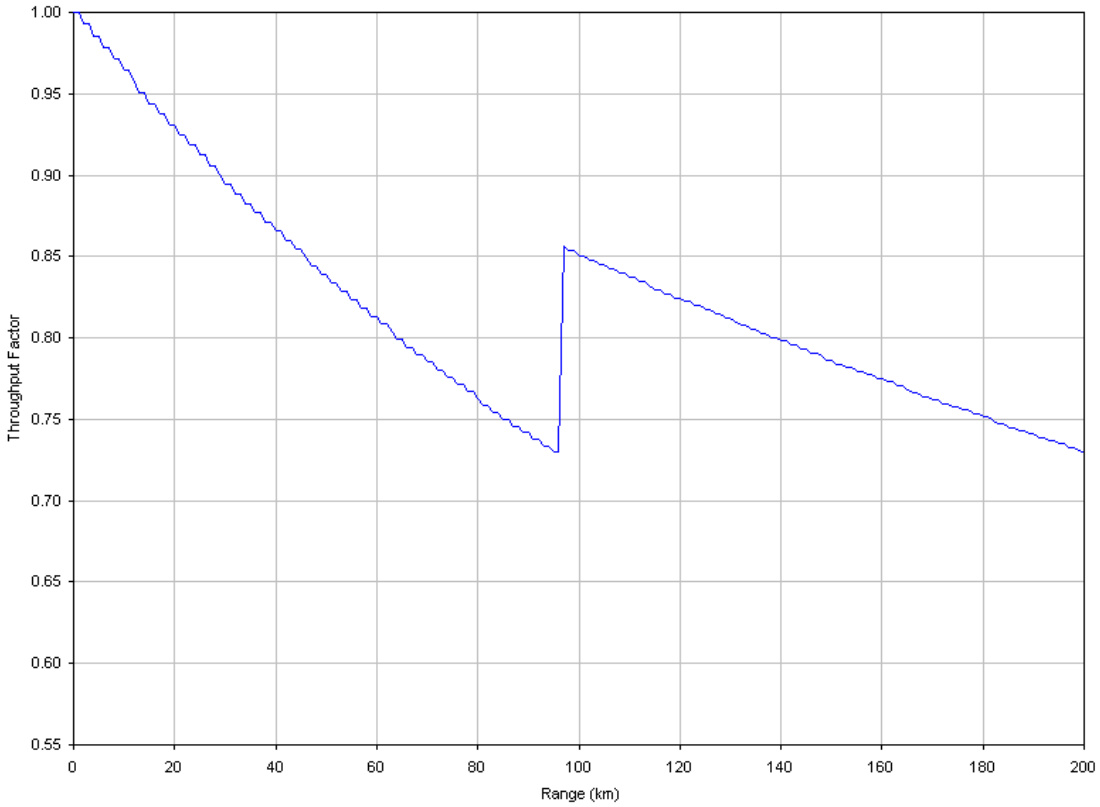
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Figure 4-41 PTP 600 range adjustment for data rates, curve N



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Figure 4-42 PTP 600 range adjustment for data rates, curve O



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Chapter 5 Installation

This chapter provides instructions for installing a PTP 600 link.

IN NO EVENT SHALL MOTOROLA, INC. BE LIABLE FOR ANY INJURY TO ANY PERSONS OR ANY DAMAGE CAUSED DURING THE INSTALLATION OF THE MOTOROLA PTP 600 SERIES PRODUCT.

⚠ CAUTION

Motorola recommends that only qualified personnel undertake the installation of a PTP 600 Series solution.

Motorola recommends that the practices and procedures detailed in manual *R56 STANDARDS AND GUIDELINES FOR COMMUNICATION SITES (68P81089E50)* should be applied to all new site build activities. This manual is provided on the PTP 600 CD-ROM.

A standard PTP 600 Series installation process consists of the following tasks:

- Preparing for standard installations on page 5-2
- Preparing and connecting cables on page 5-3
- Installing the ODU and top LPU on page 5-12
- Installing the drop cable and ground cables on page 5-18
- Installing the PIDU Plus on page 5-24

The following tasks may also be required for installation options:

- Installing a connectorized ODU and antenna on page 5-28
- Installing an UltraSync GPS receiver on page 5-34
- Installing a PTP-SYNC unit on page 5-37
- Installing a GPS receiver for PTP-SYNC on page 5-42
- Installing an E1 or T1 interface on page 5-49

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Preparing for standard installations

NOTE

It is common practise to pre-configure the ODUs during staging before site installation. Refer to Chapter 6 Configuration and alignment for more information.

Before proceeding with the installation, perform the following checks:

- Check that a link plan is available and that it is based on the principles described in Chapter 2 Planning considerations.
- Check that the correct components are available. For a typical inventory, refer to Inventory for standard installations on page 4-2.
- Check the contents of all packages against the parts lists shown in their packing lists.
- Ensure that qualified installers are available to undertake the work.
- Ensure that all safety precautions can be observed.

The following specific tools are required to install a PTP 600 Series, in addition to general tools:

- 13mm wrench and 22 mm wrench for use with the glands.
- RJ45 crimp tool (it must be the correct tool for the type of RJ45 being used).
- Personal Computer (PC) with 10, 100 or 1000 BaseT Ethernet.
- Either Internet Explorer 7, Internet Explorer 8, Firefox 3 or Firefox 3.5.
- Ethernet patch cables.

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Preparing and connecting cables

This section describes some procedures that may be performed repeatedly during site installation. These procedures are:

- Preparing the drop cable on page 5-3
- Grounding the drop cable on page 5-5
- Connecting the drop cable to an ODU or LPU on page 5-9
- Disconnecting the drop cable from an ODU or LPU on page 5-11

Preparing the drop cable

Perform this task to prepare the outdoor CAT5e cable with connectors and glands.

The maximum cable length between the ODU and the user's network equipment is 100m (330 ft). Cable lengths up to 300m (984 ft) can be used where the PIDU Plus to ODU cable is supplying power only, that is, when using the PTP 600 Series optical interface.

For details of supported cables and recommended connectors, refer to Cable and connector specifications on page 4-16.

Safety precautions

⚠ WARNING

The metal screen of the drop cable is very sharp and may cause personal injury.

When preparing the drop cable, take the following safety precautions:

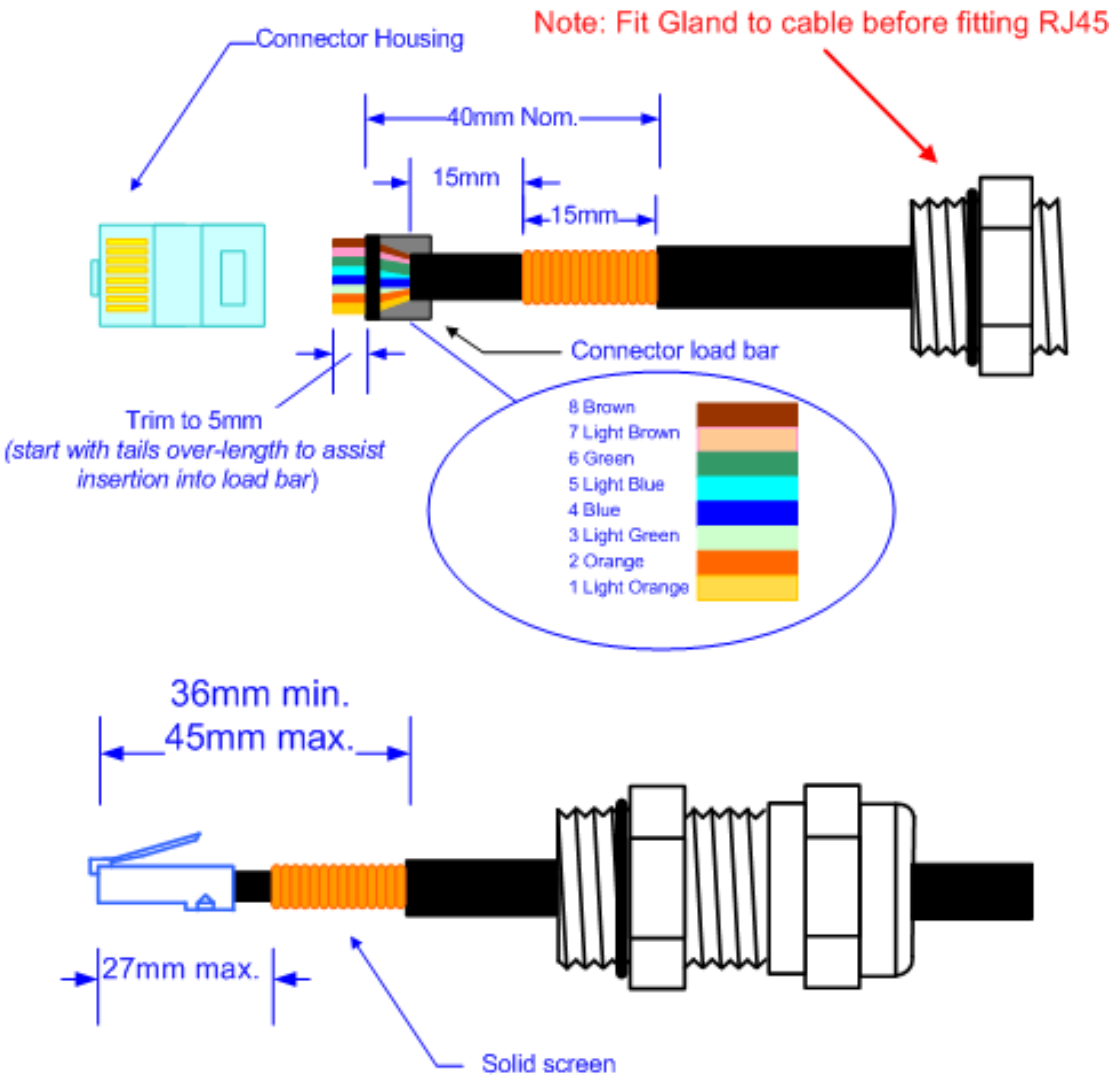
- ALWAYS wear cut resistant gloves (check the label to ensure they are cut resistant).
- ALWAYS wear protective eyewear.
- ALWAYS use a rotary blade tool to strip the cable (DO NOT use a bladed knife). To use the rotary blade tool, fit it around the outer cable sheath and rotate the cutter around the cable once or twice. The stripped outer section can then be removed.

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Assembly

Assemble the drop cable as shown in Figure 5-1. The gland is only required for outdoor connections, that it, at the ODU or LPU. The connection to the PIDU Plus requires the RJ45 plug but no gland.

Figure 5-1 Correct cable preparation for drop cable of the supported type



⚠ CAUTION

Check that the crimp tool matches the RJ45 connector being used, otherwise the cable or connector may be damaged.

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⚠ CAUTION

The cable inner sheath must be located correctly under the connector housing tang. If this is not done correctly, there is no strain relief on the cable terminations.

Figure 5-2 shows the end of a drop cable fitted with an RJ45 plug and a gland.

Figure 5-2 Drop cable with RJ45 and gland



Grounding the drop cable

Perform this task to connect the screen of the drop cable to the metal of the supporting structure using a cable grounding kit.

The cable grounding kit for 1/4” and 3/8” cable (Figure 1-14) contains the following components:

- 1 x grounding cable with grounding 2 hole lug fitted (M10)
- 1 x self Amalgamating tape
- 1 x PVC tape
- 3 x tie wraps
- 2 x bolt, washer and nut

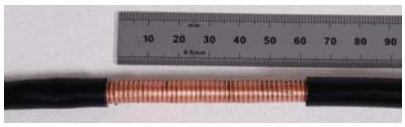
⚠ CAUTION

Ground cables must be installed without drip loops and pointing down towards the ground, otherwise they may not be effective.

To ground the drop cable to a metal structure, proceed as follows:

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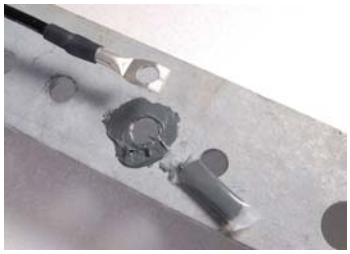
Procedure 5-1 Ground the drop cable

1	Remove 60mm (2.5inches) of the drop cable outer jacket. 
2	Cut 38mm (1.5 inches) of rubber tape (self amalgamating) and fit to the ground cable lug. Wrap the tape completely around the lug and cable. 
3	Fold the ground wire strap around the drop cable screen. Fit cable ties and tighten with pliers. 
4	Cut the surplus from the cable ties. Cut a 38mm (1.5 inches) section of self-amalgamating tape and fit to the ground cable lug. Wrap the self-amalgamating tape completely around the lug and cable. 

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5	Use the remainder of the self-amalgamating tape to wrap the complete assembly. Press the tape edges together so that there are no gaps. 
6	Wrap a layer of PVC tape, starting from 25mm (1 inch) above the outer jacket and finishing 25mm (1 inch) below the self-amalgamating tape, over lapping at half width. 
7	Repeat with a further four layers of PVC tape. Start the second layer 25mm (1 inch) above the first layer tape, start the third layer below the finish of the second layer. Continue until five layers have been applied, always over lapping at half width. 

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8	If a single hole tag is required at the mast end, modify the two hole tag as shown. 
9	Apply the anti-oxidant compound liberally applied between the two metals. If paint is present, remove it to provide a good electrical contact. 

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Connecting the drop cable to an ODU or LPU

Perform this task to connect the drop cable to an ODU or LPU. This procedure contains illustrations of an ODU, but it applies in principle to both the ODU and the LPU.

NOTE

For the ODU drop cable, always use LPU type WB2900B or later. Do not use LPU type WB2900.

To connect the drop cable with a gland to a unit (LPU or ODU), proceed as follows:

Procedure 5-2 Connect the drop cable with a gland to a unit (LPU or ODU)

1	Insert the RJ45 plug into the socket in the unit, making sure that the locking tab snaps home. 
2	Support the drop cable and gently hand screw the gland body into the unit until the O ring seal is flush to the unit body.  **NOTE** Do not fit the back shell prior to securing the gland body.

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3	Once the gland is fully hand screwed into the unit, tighten it with a spanner to torque 10 Nm (7.4 ftlbs). 
4	When the gland body has been fitted, tighten the gland back shell.  **⚠ CAUTION** Do not over-tighten the gland back shell, as the internal seal and structure may be damaged. Figure 5-3 shows correctly tightened and over-tightened gland back shells.

Figure 5-3 Correct and incorrect tightening of cable gland back shell



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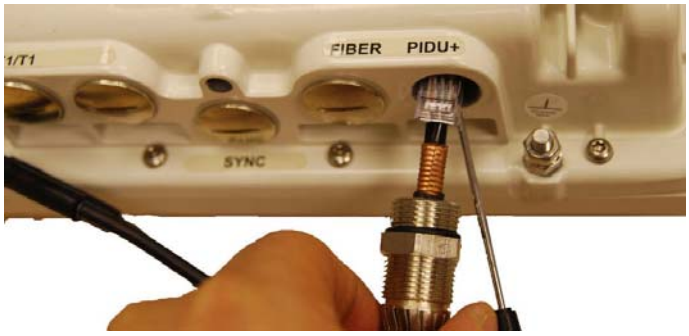
Disconnecting the drop cable from an ODU or LPU

NOTE

This procedure contains illustrations of an ODU, but it applies in principle to both the ODU and the LPU.

To disconnect the drop cable with a gland from a unit (LPU or ODU), proceed as follows:

Procedure 5-3 Disconnect the drop cable with a gland from a unit (LPU or ODU)

1	Remove the gland back shell.
2	Wiggle the drop cable to release the tension of the gland body.  When the tension in the glad body is released, a gap opens at the point shown in red in the above photograph.
3	Unscrew the gland body.
4	Use a small screwdriver to depress the RJ45 locking cap 
5	Unplug the RJ45.

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Installing the ODU and top LPU

Perform this task to install the ODU and top Lightning Protection Unit (LPU) on the supporting structure.

This task consists of the following procedures:

- Checking the mounting bracket and pole on page 5-12
- Selecting a mounting option for the top LPU on page 5-14
- Checking that it is safe to hoist the ODU on page 5-15
- Mounting the ODU and top LPU on page 5-16

Checking the mounting bracket and pole

⚠ WARNING

To prevent failure of the assembly, do not remove the mounting bracket, and do not mount the ODU on a pole that is too narrow or too wide.

Check that the ODU is pre-fitted with a mounting bracket (designed to ease installation) and with earth bonding leads (Figure 5-4).

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Figure 5-4 ODU with mounting bracket and earth bonding leads



Do not mount the ODU on poles with diameter less than 50mm (2”) or greater than 75mm (3”). The ODU mounting bracket is designed to work only with poles with diameter in the 50 mm (2”) to 75 mm (3”) range.

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Selecting a mounting option for the top LPU

Select the most suitable mounting option for the top LPU (Figure 5-5). The two alternative options are:

- **Option 1**: The LPU is mounted back-to-back with the ODU, using the brackets supplied with the ODU. This is the configuration recommended by Motorola.
- **Option 2**: The LPU is mounted separately from the ODU, using the U-bolt bracket supplied with the PTP LPU kit.

Figure 5-5 Top LPU mounting options

Option 1:



Option 2:



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Checking that it is safe to hoist the ODU

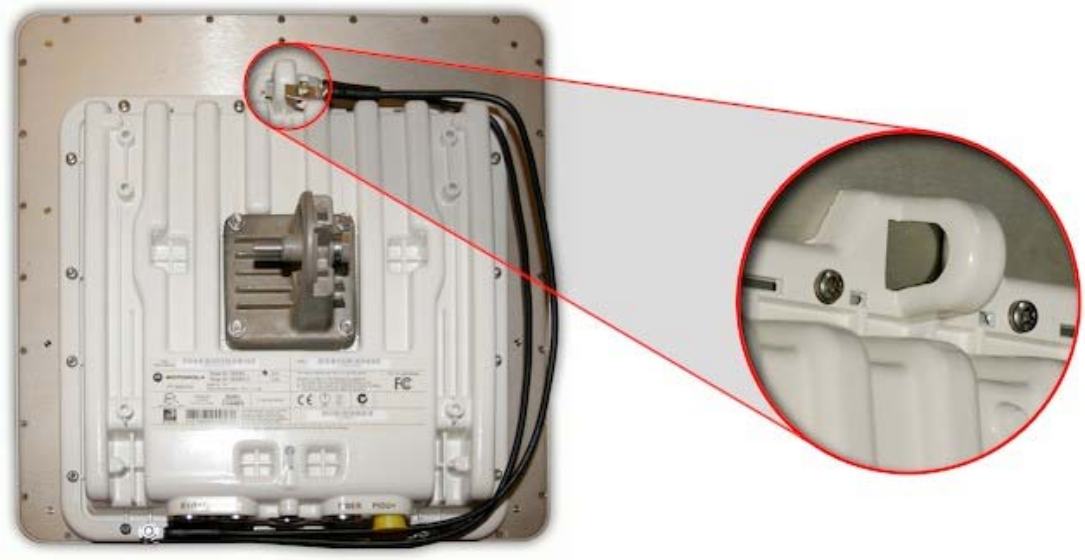
⚠ WARNING

To minimize the risk of injury, do not attempt to hoist the ODU until the necessary precautions have been taken.

Before hoisting the ODU, take the following precautions:

- Check that the safety loop (Figure 5-6) and its fixing are not damaged in any way and have not been exposed to a shock loading due to a fall.
- Check that the safety lanyard does not exceed 1m (approx 3 ft) in length.
- Check that the safety lanyard is made from a material that does not degrade in an outdoor environment.
- Check that the safety lanyard is fixed to a separate point that is not part of the direct mounting system for the ODU.

Figure 5-6 Integral safety loop



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Mounting the ODU and top LPU

⚠ WARNING

To prevent failure of the assembly, do not over-tighten the bolts.

The ODU must be mounted using the following steps, ensuring that the cable entry is at the bottom:

Procedure 5-4 Mounting the ODU and top LPU

1	Check the contents of the ODU and LPU boxes.
2	Select the most suitable mounting option for the top LPU and ODU, as described in Selecting a mounting option for the top LPU on page 5-14.
3	Attach the ODU bracket strap to the pole using M8 x 70 mm bolts, M8 flat washers and M8 coil washers.  If LPU mounting option 1 (back-to-back) has been chosen, mount the LPU on the bracket bolts. The LPU must be vertical with cable glands facing downwards. Tighten to ensure the assembly grips, but can be adjusted on the pole.
4	Use the integral safety loop (Figure 5-6) to hoist the ODU up to the bracket, observing the safety precautions listed in Checking that it is safe to hoist the ODU on page 5-15.
5	When the ODU is in position, use the safety loop as a fixing point to secure a permanent lanyard from the supporting structure to the ODU, as a precaution against mounting failure.

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6	Offer the ODU (with pre-fitted mounting bracket) to the bracket strap and affix using the captive M8 bolt. Tighten to ensure the assembly grips, but can be adjusted on the pole. 
7	Adjust the elevation and azimuth of the unit to achieve an approximate visual alignment (does not apply to connectorized ODUs). Tighten both nuts to the required torque settings of 14 Nm (11 lb ft). 
8	If LPU mounting option 2 (U-bolt) has been chosen, mount the LPU using the U-bolt bracket. The LPU must be vertical with cable glands facing downwards.

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Installing the drop cable and ground cables

Perform this task to install the drop cable connection from the ODU to the PIDU Plus, and to provide grounding and lightning protection for the installation.

This task consists of the following procedures:

- Connecting the ODU to the top LPU on page 5-19.
- Installing and grounding the drop cable on a mast on page 5-20.
- Installing and grounding the drop cable at building entry on page 5-22.

⚠ CAUTION

The drop cable and ground cable installation must meet the requirements defined in Grounding and lightning protection on page 2-14.

⚠ CAUTION

To provide effective protection against lightning induced surges, grounding cables must be installed without drip loops and pointing down towards the ground.

⚠ CAUTION

To avoid damage to the installation, do not connect or disconnect the drop cable when power is applied to the PIDU Plus.

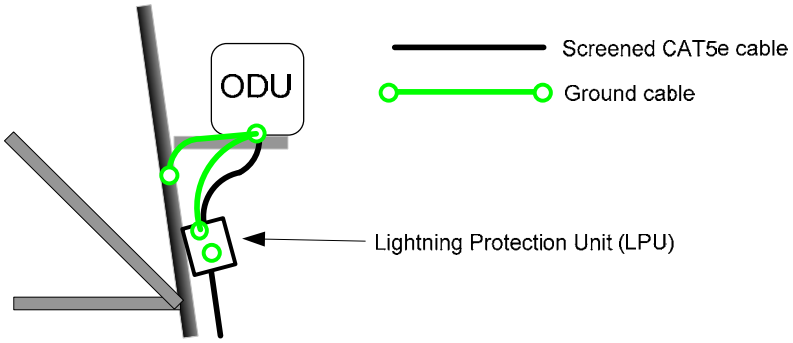
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Connecting the ODU to the top LPU

Perform this procedure to connect the ODU to the top lightning protection unit (LPU) via ground and drop cables, and to ground the ODU to the supporting structure (Figure 5-7).

It is often easier to connect the ODU to the short drop cable (that leads to the top LPU) on the ground or a suitable surface prior to mounting the ODU.

Figure 5-7 ODU and top LPU grounding



To connect and ground the ODU and top LPU, proceed as follows:

Procedure 5-5 Connect ODU and LPU

1	Prepare two sections of drop cable with the correct glands and connectors, as described in Preparing the drop cable on page 5-3: One is a short length (not more than 600 mm) to connect the ODU to the top LPU. Use the back-to-back cable supplied in the LPU kit. The other is a long one to connect the top LPU to the bottom LPU.
2	Connect one end of the back-to-back cable to the PIDU Plus port of the ODU as described in Connecting the drop cable to an ODU or LPU on page 5-9. 

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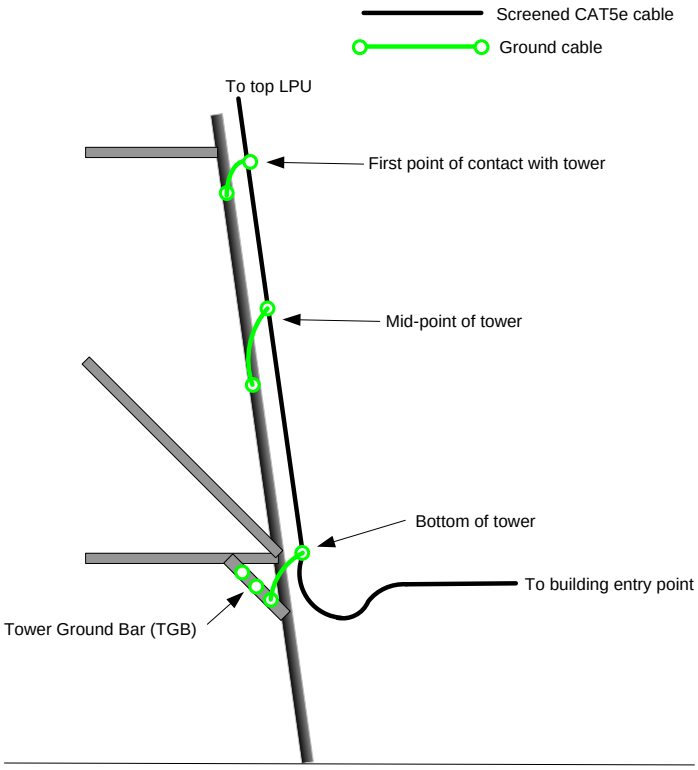
3	Connect the other end of the back-to-back cable to the LPU (either port) as described in Connecting the drop cable to an ODU or LPU on page 5-9.
4	Connect one end of the long drop cable to the LPU (unused port) as described in Connecting the drop cable to an ODU or LPU on page 5-9.
5	The ODU is supplied with two ground cables of length 0.6 meters (2 ft). Connect the small lug to the LPU. Connect the large lug to the mast grounding point (if necessary, remove paint and apply anti-oxidant compound first). All upper tower grounds should be within 0.3 meters (1 ft) of the ODU bracket and on the same metal. **⚠ CAUTION** Do not attach the grounding cables to the mounting bracket bolts, as this arrangement will not provide full protection.
6	To prevent corrosion and possible loss of ground continuity, weatherproof the grounding points.

Installing and grounding the drop cable on a mast

If the ODU is installed on a metal mast or tower (Figure 5-8), perform this procedure to install and ground the drop cable from the top LPU to the building entry point. The drop cable must be grounded to the mast at the points specified in Protection requirements for a mast or tower installation on page 2-17.

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Figure 5-8 Drop cable grounding on a mast or tower



To install and ground the drop cable down the mast, proceed as follows:

Procedure 5-6 Install and ground drop cable down the mast

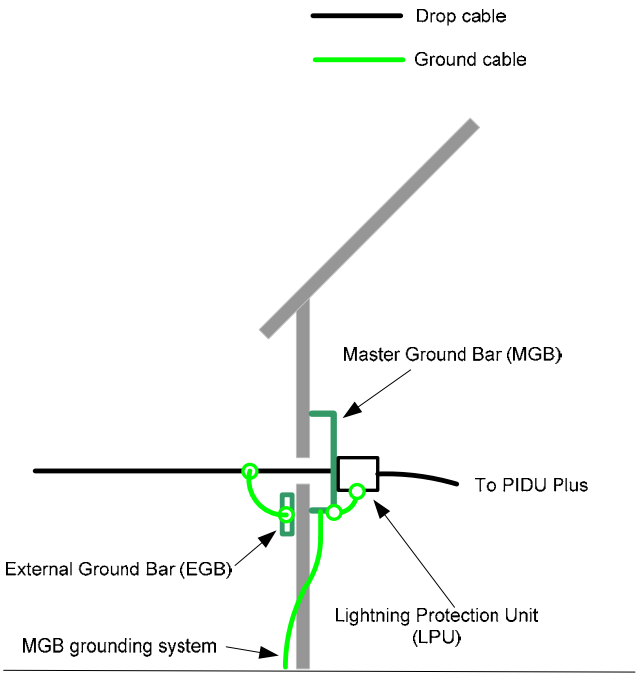
1	Check that the long drop cable is connected to the mast top LPU.
2	Lay the drop cable as far as the building entry point, ensuring there is enough length to extend through the wall of the building to the LPU inside.
3	Attach the drop cable to the mast using the cable ties provided.
4	At the first point of contact between the drop cable and the mast, near the top, ground the drop cable to the mast as described in Grounding the drop cable on page 5-5.
5	At the mid point of the mast, and at any additional grounding points, ground the drop cable to the mast as described in Grounding the drop cable on page 5-5.
7	At the point where the drop cable leaves the mast, ground it to the ground bar as described in Grounding the drop cable on page 5-5.

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Installing and grounding the drop cable at building entry

Perform this procedure to install and ground the drop cable at the building (or cabinet) entry point (Figure 5-9).

Figure 5-9 Grounding at building entry



To run the drop cable into the building, proceed as follows:

Procedure 5-7 Install and ground drop cable at building entry

1	Check the contents of the LPU box.
2	Make an entry point into the building and run the long drop cable into the building.
3	Ground the drop cable to the external ground bar outside the building entry point, as described in Grounding the drop cable on page 5-5.
4	Install the bottom LPU inside the building entry point. Mount the LPU vertically with cable glands facing downwards.
5	Ground the bottom LPU to the master ground bar.

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6	Connect the long drop cable to the bottom LPU, as described in Connecting the drop cable to an ODU or LPU on page 5-9.
7	Prepare a short section of drop cable with the correct gland (at the LPU end) and RJ45 connectors, as described in Preparing the drop cable on page 5-3. This is to connect the bottom LPU to the PIDU Plus or PTP-SYNC (if installed).
8	Connect the short drop cable to the bottom LPU, as described in Connecting the drop cable to an ODU or LPU on page 5-9, and run it to the location of the PIDU Plus or PTP-SYNC (if installed).

NOTE

If it is necessary to disconnect the drop cable, refer to Disconnecting the drop cable from an ODU or LPU on page 5-11.

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Installing the PIDU Plus

Perform this task to install the PIDU Plus and connect it to the ODU and network cables.

This task consists of the following procedures:

- Mounting the PIDU Plus on page 5-24
- Connecting the PIDU Plus to the ODU cable on page 5-24
- Forming a drip loop on page 5-26
- Preparing the PIDU Plus to LAN cable on page 5-27
- Dressing the PIDU Plus cables on page 5-27

Mounting the PIDU Plus

Mount the PIDU Plus on a wall or other suitable mounting surface, at a height that protects it from flooding or rising damp.

Mount it using the lugs provided, as this prevents the unit from being knocked or kicked and can help maintain link availability.

Ensure that the Recovery switch can be accessed when mounting the unit.

⚠ CAUTION

The PIDU Plus is not waterproof and should be mounted away from sources of moisture. If mounted outdoors, the unit should be mounted in a rain proof enclosure, preferably ventilated.

Connecting the PIDU Plus to the ODU cable

The cable from the ODU is connected to the PIDU Plus by means of a concealed RJ45 socket.

⚠ CAUTION

Plugging other equipment into the ODU RJ45 socket may damage the equipment due to the non-standard techniques employed to inject DC power into the 1000BaseT connection between the PIDU Plus and the ODU. Plugging the ODU into other equipment may damage the ODU and/or the other equipment.

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To connect the PIDU Plus to the cable from the ODU, proceed as follows:

Procedure 5-8 Connecting the PIDU Plus to the ODU

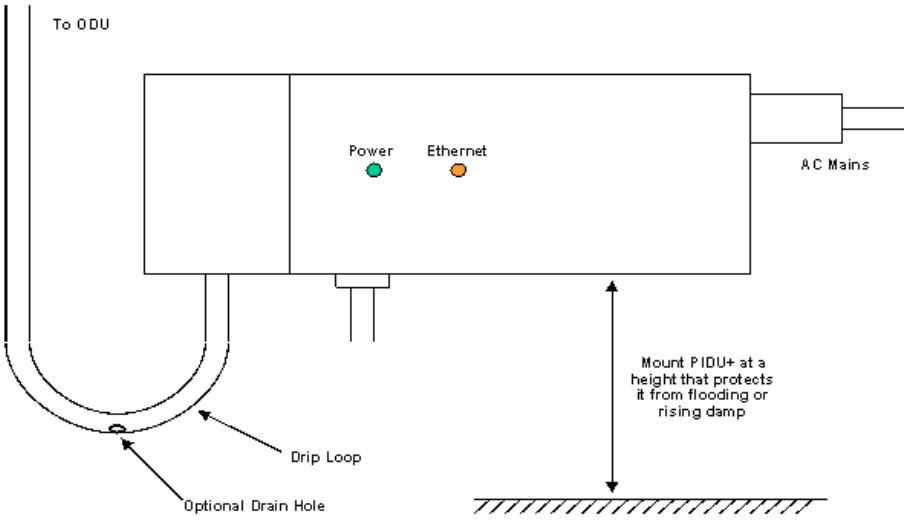
1	Undo the retaining screw and hinge back the cover. 
2	Plug in the cable from the LPU (or PTP-SYNC if installed), ensuring that it snaps home. 
3	Replace the cover and secure with the retaining screw. 

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Forming a drip loop

Form a drip loop on the cable from the LPU (Figure 5-10). This ensures that any moisture that runs down the cable into the cabinet or enclosure cannot enter the PIDU Plus. The network connection and mains cable should be treated in the same way if there is a risk that they can carry moisture to the PIDU Plus.

Figure 5-10 PIDU Plus drip loop configuration



CAUTION

If the recommended gel filled drop cable is not used, it is possible for moisture to enter the cable due to damage to the outer protective layer. This moisture can track down the inside of the cable, filling up the drip loop and eventually finding its way into the PIDU Plus. To protect against this, the outer protective layer of the cable can be opened up at the bottom of the drip loop to allow this moisture to escape.

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Preparing the PIDU Plus to LAN cable

Prepare the CAT5e cable that will connect the PIDU Plus to the network equipment. This cable must meet the following requirements:

- Use either foil screen (FTP) or braided screen (STP) cable.
- Use screened RJ45 connectors with metal shells at both ends.
- Ensure there is a continuous electrical connection between both screened connectors.

⚠ CAUTION

The connected network equipment must feature screened RJ45 connectors and must be connected to ground, otherwise the PIDU Plus will not be grounded.

The PIDU Plus is not normally connected to the network equipment until antenna alignment is complete. See Task 11: Connect link to the network on page 6-83.

Dressing the PIDU Plus cables

⚠ CAUTION

Do not dress the PIDU Plus cables too tightly, as this may make the connections unreliable.

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Installing a connectorized ODU and antenna

Perform this task to install a connectorized ODU with a separate antenna.

This task consist of the following procedures:

- Preparing for connectorized installations on page 5-28
- Mounting the connectorized ODU on page 5-28
- Mounting the antenna on page 5-29
- Connecting the ODU and antenna on page 5-29
- Weatherproofing the antenna connections on page 5-29
- Grounding the antenna cables on page 5-30
- Fixing the antenna cables on page 5-33

Preparing for connectorized installations

Before proceeding with the installation, perform the following checks:

- Check that the correct components are available. For a typical inventory, refer to Inventory for connectorized bridge installations on page 4-5.
- Check that the selected antenna conforms to the applicable regulatory restrictions, as described in Antenna specifications on page 4-18 and Electromagnetic compliance on page 4-90.
- Check that the correct tools are available. The tools required for mounting a connectorized ODU are the same as those required for an integrated ODU, detailed in Preparing for standard installations on page 5-2. The tools required for mounting the antennas are specific to the antenna chosen. Refer to the antenna manufacturer’s instructions.

Mounting the connectorized ODU

Mount the connectorized ODU in a position that gives it maximum protection from the elements, but still allows easy access for connecting and weatherproofing the cables. To minimize cable losses, mount the ODU where the antenna cable lengths can be minimized.

Follow the same procedure as that used for mounting the integrated ODU, as described in Installing the ODU and top LPU on page 5-12.

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Mounting the antenna

Mount the antenna according to manufacturer's instructions.

Spatial diversity

When using separate antennas to achieve spatial diversity, mount one with Horizontal polarization and the other with Vertical polarization. It is not necessary to mount the ODU at the mid point between the antennas.

Connecting the ODU and antenna

Connect the ODU to the antenna with cables of type LMR100, LMR200, LMR300, LMR400 or LMR600. Use the ODU 'V' interface for vertical polarization and the 'H interface for horizontal polarization (Figure 1-5).

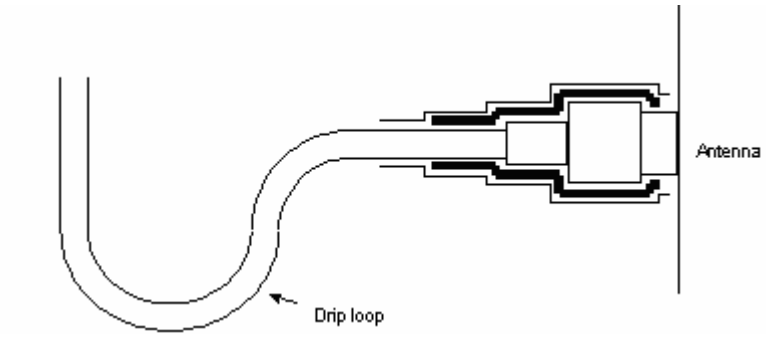
NOTE

If separate antennas have been installed for spatial diversity, the antenna cables will be disconnected from the ODU during the alignment procedure. Therefore, do not weatherproof the ODU joints until antenna alignment is complete. Refer to Aligning separate antennas on page 6-77.

Weatherproofing the antenna connections

When dressing the antenna cables, form drip loops near the lower ends. These ensure that water is not constantly channeled towards the connectors.

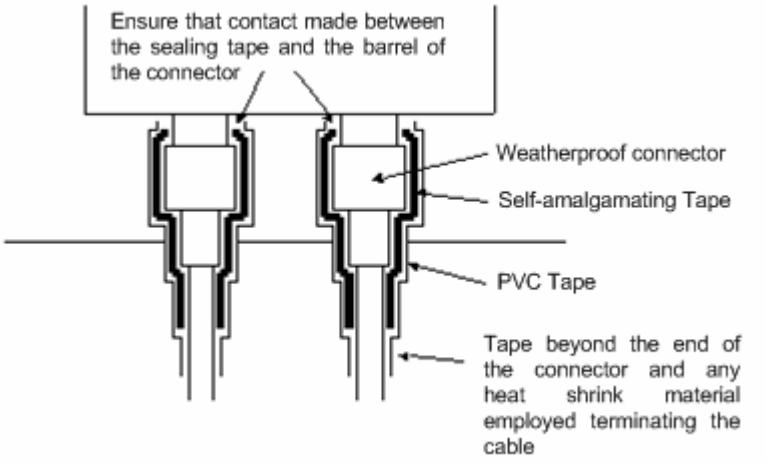
Figure 5-11 Forming a drip loop



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Weatherproof the ODU joints using self-amalgamating tape under a layer of PVC tape (Figure 5-12). If the antenna manufacturer has not supplied guidance on this matter, the same technique should be employed at the antenna end of the cables.

Figure 5-12 Weatherproofing the antenna connections



Grounding the antenna cables

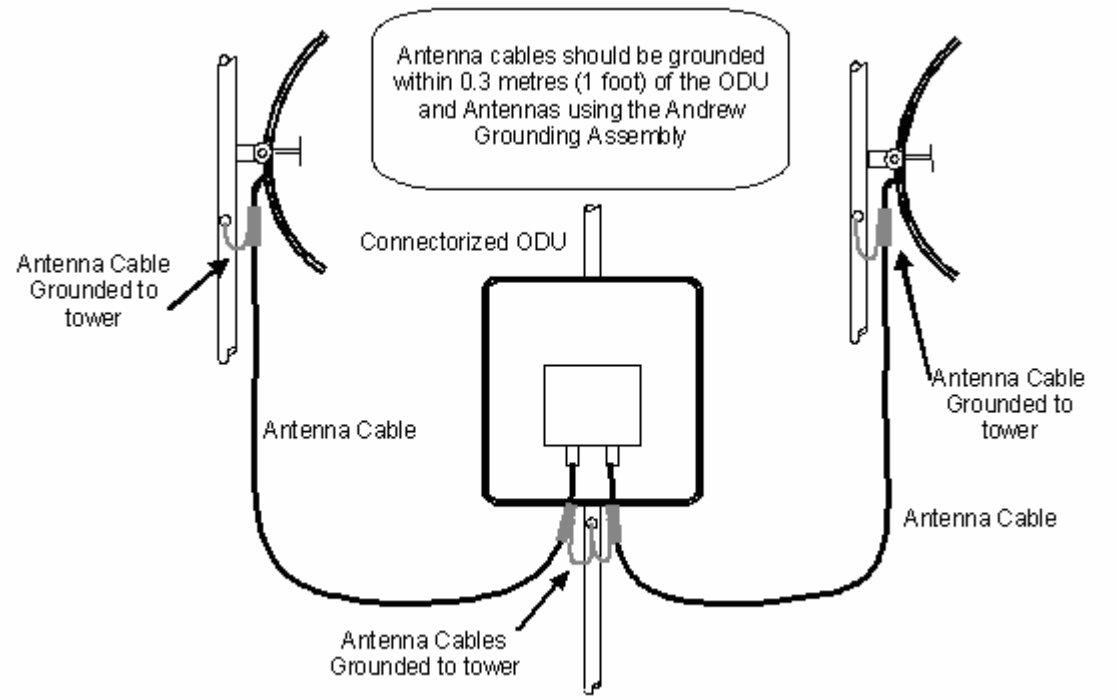
Ground the antenna cables to the supporting structure at the points shown in Figure 5-13.

NOTE

If the antenna is mounted on a mast or tower, the antenna cables may have to be grounded at additional points. To identify any additional grounding points, refer to Protection requirements for a mast or tower installation on page 2-17.

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Figure 5-13 Grounding points for antenna cables

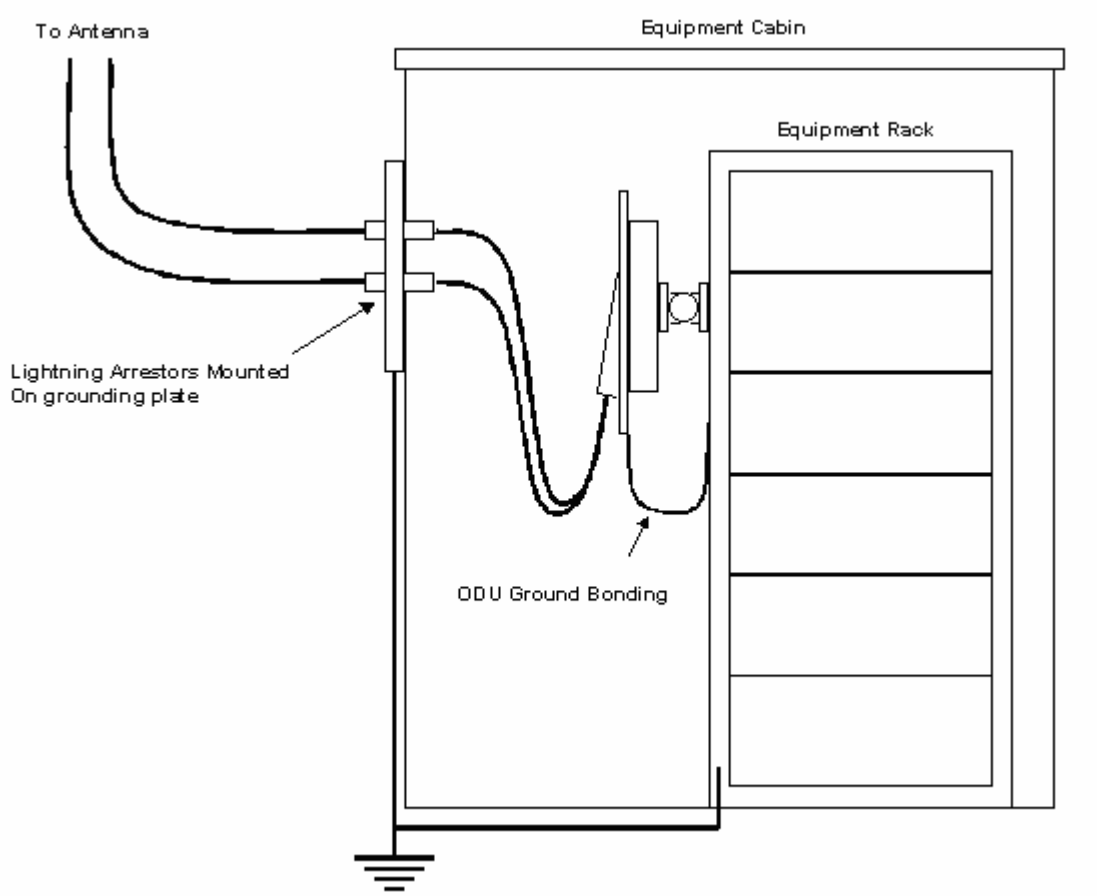


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ODU mounted indoors

Where the ODU is mounted indoors, install lightning arrestors at the building entry point (Figure 5-14).

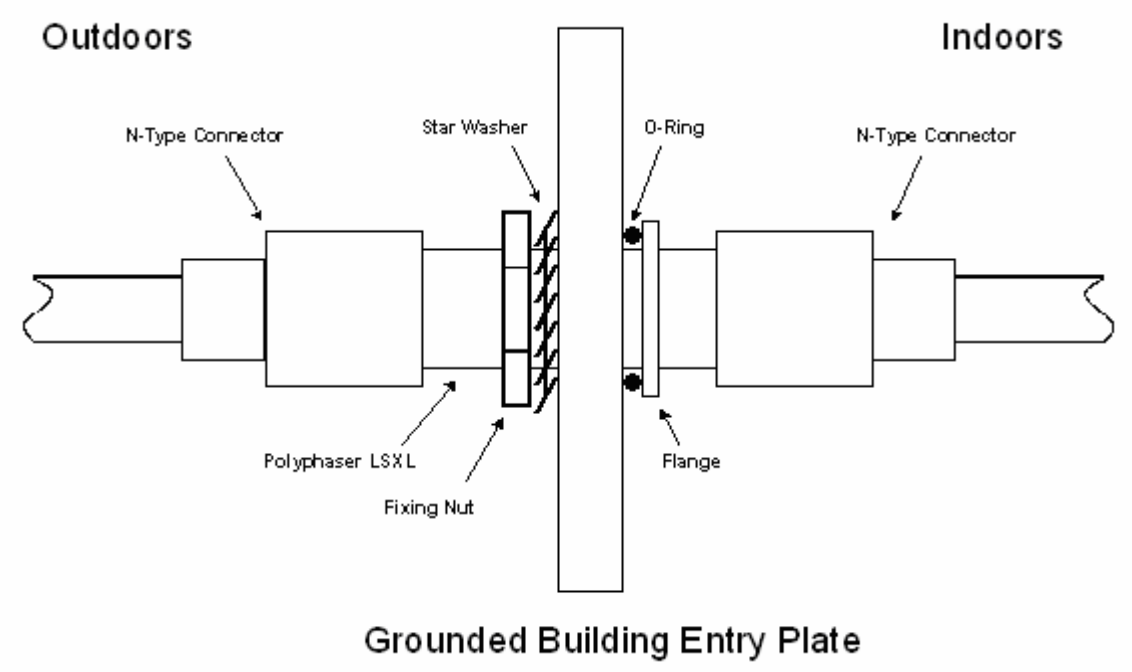
Figure 5-14 Lightning arrestor mounting



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The Polyphaser LSXL-ME or LSXL is a supported type of lighting arrestor for the antenna cables. This should be assembled as shown in Figure 5-15.

Figure 5-15 Polyphaser assembly



Connect the lighting arrestors to the master ground bar of the building.

Fixing the antenna cables

Dress the antenna cables and fix them using cable ties, cleats or PVC tape.

⚠ CAUTION

Ensure that no undue strain is placed on the ODU or antenna connectors. Ensure that the cables do not flap in the wind, as flapping cables are prone to damage and induce unwanted vibrations in the supporting structure.

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Installing an UltraSync GPS receiver

If the chosen TDD synchronization method requires UltraSync GPS (see TDD synchronization configurations supported on page 2-27), then perform this task to install the UltraSync receiver.

This task consists of the following procedures:

- Preparing for UltraSync installation on page 5-34
- Connecting the UltraSync unit on page 5-35
- Checking the complete UltraSync unit installation on page 5-36

Preparing for UltraSync installation

Check that the correct components are available. For a typical inventory, refer to Inventory for UltraSync installations on page 4-7.

Refer to the UltraSync user manual for details on the lengths and types of cables used to connect the UltraSync to the ODU and LPU.

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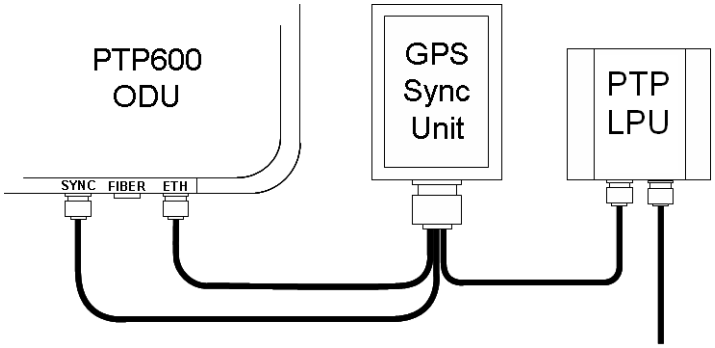
Connecting the UltraSync unit

Connect the UltraSync unit to the ODU and top LPU as shown in Figure 5-16 and Figure 5-17.

Figure 5-16 UltraSync unit connections



Figure 5-17 UltraSync deployment diagram



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Checking the complete UltraSync unit installation

Check that the UltraSync installation is correct. Figure 5-18 is an example of mast installation using lightning protection and an UltraSync unit.

Figure 5-18 UltraSync unit complete installation



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Installing a PTP-SYNC unit

If the chosen TDD synchronization method requires PTP-SYNC (see TDD synchronization configurations supported on page 2-27), then perform this task to install a PTP-SYNC unit.

This task consists of the following procedures:

- Preparing for PTP-SYNC installation on page 5-37
- Mounting the PTP-SYNC unit on page 5-38
- Connecting up the PTP-SYNC unit on page 5-39
- Powering up the PTP-SYNC installation on page 5-41

⚠ CAUTION

The PTP-SYNC unit should not be installed in a domestic (home) environment as it is a Class A product. In a domestic environment, it may cause radio frequency (RF) interference in other appliances.

⚠ CAUTION

The PTP-SYNC unit must be installed indoors in a non-condensing environment, otherwise it will be prone to water damage.

⚠ CAUTION

To protect the PTP-SYNC from damage, disconnect the power supply from the PIDU Plus before connecting up the PTP-SYNC.

Preparing for PTP-SYNC installation

Check that the correct components are available. For a typical inventory, refer to Inventory for PTP-SYNC installations on page 4-8.

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Mounting the PTP-SYNC unit

Install the PTP-SYNC unit in the equipment building, either in a rack or on a wall.

Rack mounting

If the PTP-SYNC is to be in a rack, fix it to the rack mount using the M3 screws from the rack mount installation kit (Figure 5-19).

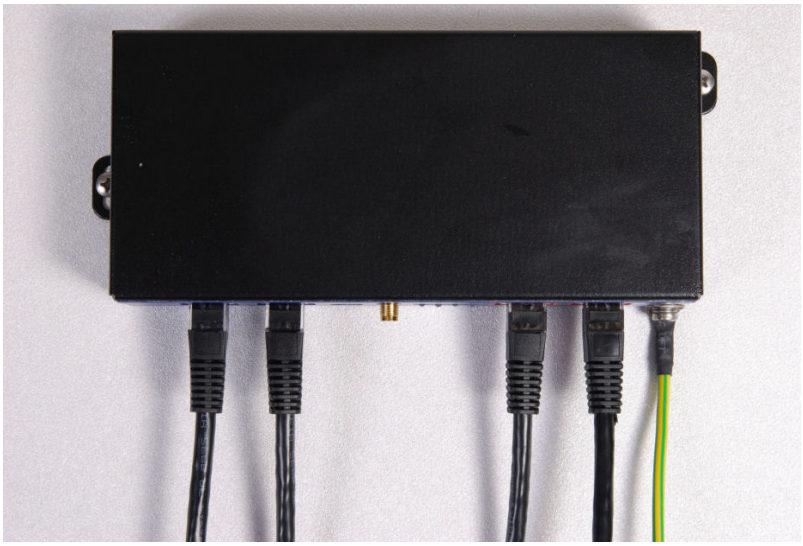
Figure 5-19 Rack mount securing screws for PTP-SYNC



Wall mounting

If the PTP-SYNC is to be on a wall, mount it vertically with interfaces and cabling facing downwards (Figure 5-20).

Figure 5-20 PTP-SYNC mounted on a wall



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Connecting up the PTP-SYNC unit

To connect the PTP-SYNC to the PIDU Plus, ODU, GPS receiver (if fitted), and LPU (if fitted), proceed as follows:

Procedure 5-9 Connect up PTP-SYNC

1	Disconnect the power supply from the PIDU Plus. 
2	If using GPS, connect the cable from the GPS unit to the GPS/SYNC IN port. 

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3	To link clustered PTP-SYNC units, connect the SYNC OUT port of the first PTP-SYNC to the GPS/SYNC IN port of the second PTP-SYNC in the chain. Repeat for subsequent PTP-SYNC units in the chain. 
4	Connect the cable from the PIDU Plus to the PIDU IN port. 
5	Connect the cable from the ODU to the ODU OUT port. 

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6	Use a grounding cable to connect the ground stud of the PTP-SYNC to the master ground bar of the building. 

Powering up the PTP-SYNC installation

To power up the installation, proceed as follows:

Procedure 5-10 Powering up PTP-SYNC

1	Ensure that all cables are connected to the correct interfaces of the PTP-SYNC unit and the GPS receiver (if used). Ensure that the installation is correctly grounded. **⚠ CAUTION** Failure to do so may result in damage to the equipment.
2	Connect the power supply to the PIDU Plus.
3	Within 90 seconds, the PTP-SYNC 'STATUS' LED should blink once every second to show that satellite lock has been achieved.
4	If the system does not operate correctly, refer to PTP-SYNC fault finding guide on page 8-19.

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Installing a GPS receiver for PTP-SYNC

If the chosen TDD synchronization method requires a GPS timing reference source (see TDD synchronization configurations supported on page 2-27), then perform this task to install a GPS receiver.

This task consists of the following procedures:

- Preparing for GPS receiver installation on page 5-42
- Mounting the GPS receiver on page 5-42
- Connecting the drop cable to the GPS receiver on page 5-43
- Grounding the GPS receiver drop cable on page 5-47
- Mounting the LPU and connecting the GPS receiver on page 5-48

⚠ CAUTION

Prior to power-up of equipment, ensure that all cables are connected to the correct interfaces of the PTP-SYNC unit and the GPS receiver module. Failure to do so may result in damage to the equipment.

Preparing for GPS receiver installation

Check that the correct components are available. For a typical inventory, refer to Inventory for GPS receiver installations on page 4-9.

Mounting the GPS receiver

Mount the GPS receiver (following manufacturer's instructions) upon either an external wall or a metal tower or mast. For more information on these options, refer to Mounting options for the PTP-SYNC GPS receiver on page 2-32.

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Connecting the drop cable to the GPS receiver

If the chosen GPS receiver is Trimble Acutime™ Gold, then follow this procedure.

The drop cable connecting the Trimble GPS receiver to the LPU must be of the supported cable type. The drop cable must have a Trimble 12-pin connector at the GPS end (supplied in the Trimble kit), and an RJ45 connector and standard gland at the LPU end.

⚠ CAUTION

The drop cable has solid copper conductors. There is a limited number of times each conductor can be bent before it fatigues and fails.

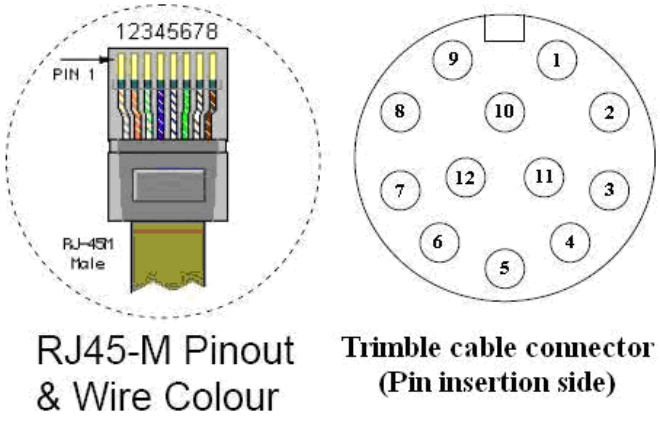
Table 5-1 shows how the Trimble connector pins (at the GPS end of the drop cable) map to the RJ45 connector pins (at the LPU end). Figure 5-21 shows the positions of the pins in each type of connector.

Table 5-1 Trimble connector to RJ45 pin mappings

Trimble 12-pin conn	Function	RJ45 wire colour		PTP-SYNC (J10) RJ45 pin
		Conventional	Supported drop cable	
1	DC Pwr (12V)	Orange/White	Light Orange	1
2	RxB-	Brown/White	Light Brown	7
3	RxB+	Brown	Brown	8
4	TxB-	Blue	Blue	4
5	TxB+	Blue/White	Light Blue	5
6	RxA-	N.C	N.C	---
7	RxA+	N.C	N.C	---
8	TxA-	N.C	N.C	---
9	DC Ground	Orange	Orange	2
10	TxA+	N.C	N.C	---
11	Tx1PPS+	Green/White	Light Green	3
12	Tx1PPS-	Green	Green	6

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Figure 5-21 RJ45 and Trimble connector pins



To connect the drop cable to the Trimble GPS receiver, proceed as follows:

Procedure 5-11 Connect drop cable to Trimble GPS receiver

1	Prepare the drop cable end as follows: Bare back the cable outer and copper screen to 50mm. Bare back the cable inner to 17mm. Un-twist the cable pairs. Strip the individual conductors to 5mm. 
2	Fit the adaptor outer, associated boot, and boot insert. 

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3	Connect the socket contacts using either of the following techniques: **Crimp** Crimp the socket contacts onto each of the conductors using the correct crimp tool and positioner, setting the wire size selector to '3' for 24AWG wire.  **Solder** When soldering the socket contacts onto each of the conductors, ensure that there is no solder or flux residue on the outside of the contact. Care should also be taken that the individual conductor insulation does not peel back with the soldering heat, allowing possible shorts when assembled into the connector shell.
4	Fit four contacts into the unused locations, to provide strength and sealing. Pin insert side: Connector mating side:  

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5	Insert the eight contacts into the connector body in accordance with Table 5-1. It is easiest to insert the pins from the inside out, in the order 12, 11, 9, 5, 4, 3, 2, 1. Push the contacts in so that the shoulder on the contact fits into the hole in the connector shell. When all contacts have been fitted, push them in further to engage with the locking mechanism in the connector shell. This can be done by applying pressure to the contact with a small diameter stiff object, such as tweezers. If a contact is pushed in to the point where the locking mechanism engages before all of the contacts have been inserted it will limit the amount of room available to fit the remaining contacts, requiring harder bends to be applied. 
6	Fit the adaptor to the connector shell. The plastic ring fits inside the rubber boot and ensures a tight fit when the adaptor body is clipped onto the connector shell. Be aware that the adaptor body is a hard push fit onto the connector shell. 
7	Fit the strain relief clip. 
8	Connect the adapter to the GPS, then wrap a layer of self-amalgamating tape, starting 25mm below the bared back outer of the cable and finishing at the GPS housing.

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9	Wrap a layer of PVC tape, starting just below the start of the self-amalgamating tape and finishing at the GPS housing, overlapping at half width. Repeat with a further four layers of PVC tape alternating the start and finish ends. 

Grounding the GPS receiver drop cable

For installations where the GPS receiver module is fitted to a metal tower or mast, ground bond the GPS receiver drop cable to the tower or mast. To identify the required grounding points, refer to Mounting the GPS receiver module on a metal tower or mast on page 2-34.

To ground the cable, follow the procedure described in Grounding the drop cable on page 5-5.

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Mounting the LPU and connecting the GPS receiver

To mount the LPU and connect it to the drop cable from the GPS receiver, proceed as follows:

Procedure 5-12 Mount LPU and connect to GPS receiver

1	Check the contents of the LPU box.
2	Mount the LPU (following manufacturer's instructions) at the point where the drop cable from the GPS receiver enters the building (Figure 2-16 or Figure 2-17). Mount the LPU vertically with cable glands facing downwards. Ground the LPU.
3	Prepare the LPU end of the GPS receiver drop cable as described in Preparing the drop cable on page 5-3.
4	Connect the cable gland of the GPS receiver drop cable to the LPU as described in Connecting the drop cable to an ODU or LPU on page 5-9.
5	Lay the drop cable from the LPU into the building up to the PTP-SYNC mounting point.

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Installing an E1 or T1 interface

Perform this task to install an optional E1 or T1 interface.

This task consists of the following procedures:

- Preparing for E1 or T1 installation on page 5-49
- Preparing the E1 or T1 drop cable on page 5-49
- Installing the E1 or T1 top LPU on page 5-49
- Connecting the ODU to the E1 or T1 top LPU on page 5-50
- Installing the E1 or T1 drop and ground cables on page 5-50
- Installing the E1 or T1 patch panel on page 5-51
- Testing the E1/T1 installation on page 5-53

Preparing for E1 or T1 installation

Check the grounding and lightning protection requirements for E1 or T1 installations, as illustrated in Figure 2-5 and Figure 2-7.

Check that the correct components are available. For a typical inventory, refer to Inventory for E1 or T1 installations on page 4-11.

⚠ CAUTION

To prevent damage to the ODU while making or breaking the connections, ensure that power is removed from the system at the PIDU Plus.

NOTE

The maximum cable length between the ODU and the customers terminating equipment is 200m (656 feet) for E1 or T1.

Preparing the E1 or T1 drop cable

Prepare the E1 or T1 drop cable as described in Preparing the drop cable on page 5-3.

Installing the E1 or T1 top LPU

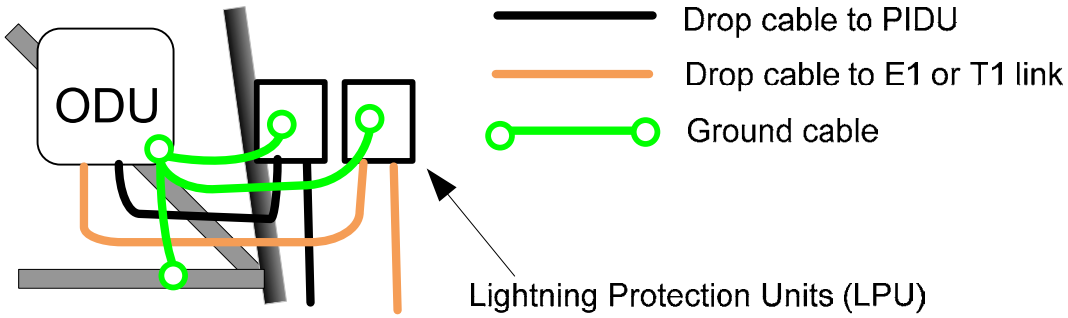
Install the top LPU for the E1 or T1 drop cable close to the ODU, using the U-bolt bracket supplied with the PTP LPU kit.

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Connecting the ODU to the E1 or T1 top LPU

Connect and ground the ODU and top LPU for E1 or T1 as described in Connecting the ODU to the top LPU on page 5-19. The connections for both the PIDU and E1 or T1 drop cables and LPU are shown in Figure 5-22.

Figure 5-22 ODU and top LPU grounding for E1 or T1



Ensure that the E1 or T1 drop cable is connected to the ODU E1/T1 port (Figure 5-23).

Figure 5-23 E1/T1 port on ODU



NOTE

If it is necessary to disconnect the E1/T1 cable from the ODU, refer to Disconnecting the drop cable from an ODU or LPU on page 5-11.

Installing the E1 or T1 drop and ground cables

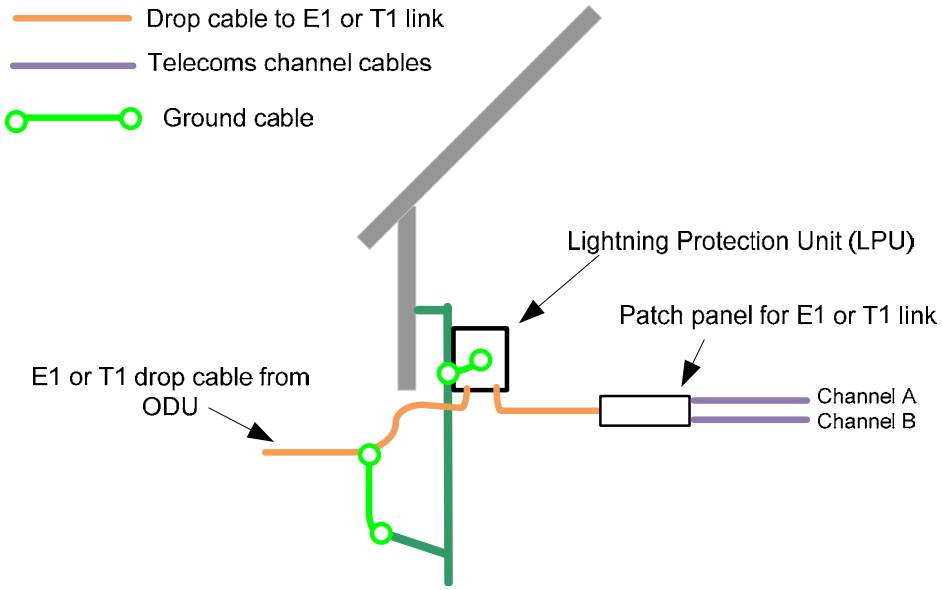
Install the E1 or T1 drop cable and bottom LPU as described in Installing the drop cable and ground cables on page 5-18.

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Installing the E1 or T1 patch panel

To connect the E1 or T1 drop cable to the two telecoms channels, install a patch panel (Figure 5-24).

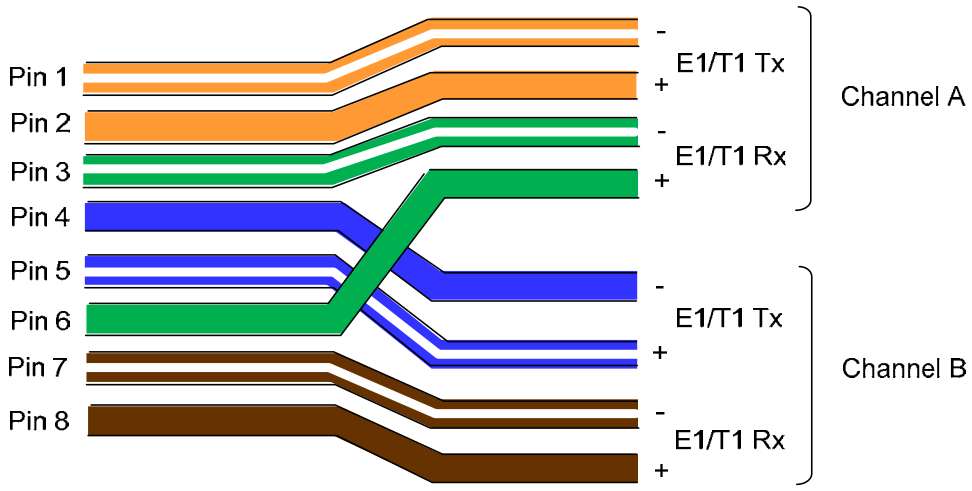
Figure 5-24 E1 or T1 patch panel



Patch panel connections

Figure 5-25 shows how the patch panel should connect the E1 or T1 drop cable to the telecoms channels. The telecoms connection pin outs are specified in Table 5-2.

Figure 5-25 RJ45 pin connections from drop cable to telecoms channels (T568B)



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Table 5-2 E1 or T1 patch panel pin outs

E1 or T1 drop cable RJ45 pin number	Connector Pinout Signal Name	120 Ohm signal balanced twisted pair RJ45 pin number	120 Ohm signal balanced twisted pair description	Telecoms channel
Pin 1	E1T1A_TX-	Pin 2	Rx Ring	A
Pin 2	E1T1A_TX+	Pin 1	Rx Tip	A
Pin 3	E1T1A_RX-	Pin 5	Tx Ring	A
Pin 4	E1T1B_TX-	Pin 2	Rx Ring	B
Pin 5	E1T1B_TX+	Pin 1	Rx Tip	B
Pin 6	E1T1A_RX+	Pin 4	Tx Tip	A
Pin 7	E1T1B_RX-	Pin 5	Tx Ring	B
Pin 8	E1T1B_RX+	Pin 4	Tx Tip	B

Baluns

The patch panel may include Baluns for transmission over 75 Ohm co-axial unbalanced lines. Such equipment should conform to the requirements of ITU G703. An example of a Balun is shown in Figure 5-26. It allows the transmit and receive data carried over a 75 Ohm cable to be converted to a balanced form for transmission over a 120 Ohm signal balanced twisted pair. The balancing of E1/T1 120 Ohm signals is illustrated in Table 5-2.

Figure 5-26 Example of a Balun



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Testing the E1 / T1 installation

Test the telecoms links by performing loopback connection tests as described in Configuring telecoms circuits on page 6-68.

Pre-power testing

Before connecting the E1/T1 source, check the following resistances:

- Check the cable resistance between pins 3 & 6 (Green/White & Green) and 7 & 8 (Brown/White & Brown). Check against Table 5-3 column 2.
- Check the cable resistance between pins 1 & 2 (Orange/White & Orange) and 4 & 5 (Blue & Blue/White). Check against Table 5-3 column 3.

Table 5-3 Resistance referenced to the E1/T1 source

CAT-5 Length (Meters)	Resistance between pins 3 & 6 and pins 7 & 8 (ohms)	Resistance between pins 1 & 2 and pins 4 & 5 (ohms)
0	0.8	1.3
10	2.5	3.0
20	4.2	4.7
30	5.9	6.4
40	7.6	8.2
50	9.3	9.8
60	11.0	11.5
70	12.7	13.2
80	14.4	14.9
90	16.1	18.2
100	17.8	18.3

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Chapter 6 Configuration and alignment

This chapter describes all configuration and alignment tasks that are performed when a PTP 600 link is deployed. However, these tasks may be revisited when adjustments to an operational link are required.

It is common practise to perform the following pre-alignment tasks during staging before site installation, although these tasks may be performed after installation, if preferred:

- Task 1: Configure IP and Ethernet interfaces on page 6-2
- Task 2: Install license keys on page 6-12
- Task 3: Upgrade software version on page 6-16
- Task 4: Configure security on page 6-21
- Task 5: Configure password policy on page 6-36
- Task 6: Set passwords on page 6-42
- Task 7: Configure wireless interface on page 6-46

The following tasks are always performed after installation is complete at both sites:

- Task 8: Align antennas on page 6-71
- Task 9: Disarm after alignment on page 6-78
- Task 10: Check link performance on page 6-82
- Task 11: Connect link to the network on page 6-83

The following tasks may be performed during staging, or after installation is complete at both sites:

- Task 12: Configure RADIUS on page 6-87
- Task 13: Set up SNMP agent on page 6-90
- Task 14: Configure alarms and messages on page 6-104
- Task 15: Configure syslog on page 6-108
- Task 16: Configure remote access on page 6-110

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Task 1: Configure IP and Ethernet interfaces

This task consists of the following procedures:

- Configuring the management PC on page 6-2
- Connecting to the PC and powering up on page 6-4
- Logging into the web interface on page 6-4
- Updating the IP and Ethernet configuration on page 6-6
- Reconnecting to the management PC on page 6-11

Configuring the management PC

To configure the local management PC to communicate with the PTP 600, proceed as follows:

Procedure 6-1 Configure the IP interface on the PC

1	Select **Properties** for the Ethernet port.
2	Select the Internet Protocol (TCP/IP) item as shown in Figure 6-1.
3	Click on **Properties**.
4	If the default IP addresses of the units are 169.254.1.2 (Master) and 169.254.1.1 (Slave), enter an IP address that is valid for the 169.254.X.X network, avoiding: 169.254.0.0 and 169.254.1.1 and 169.254.1.2 If the default IP addresses of the units are 10.10.10.11 (Master) and 10.10.10.10 (Slave), enter an IP address that is valid for the 10.10.X.X network, avoiding: 10.10.0.0 and 10.10.10.10 and 10.10.10.11 For example, the interface in Figure 6-2 is configured with an IP address of 169.254.1.3.
5	Enter a subnet mask of 255.255.0.0. Leave the default gateway blank.

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Figure 6-1 IP configuration on the PC

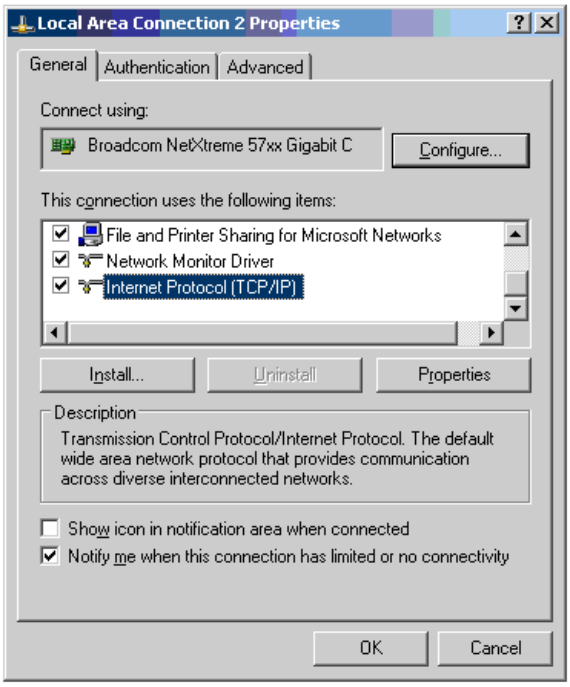
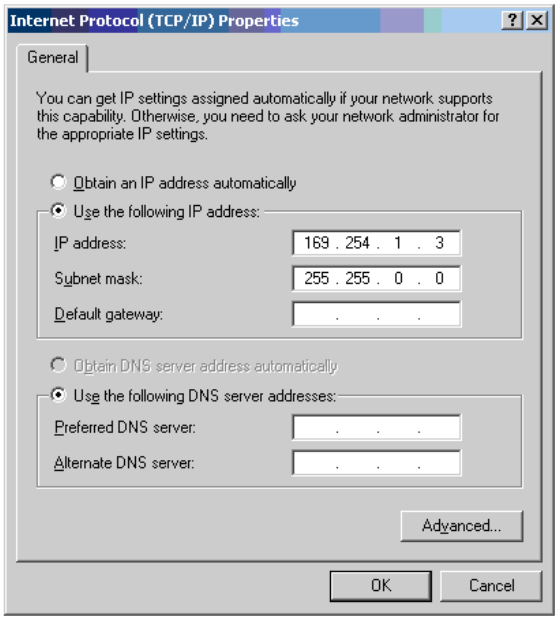


Figure 6-2 Internet Protocol (TCP/IP) Properties page



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Connecting to the PC and powering up

To connect the PTP 600 to the PC and power up the unit, proceed as follows:

Procedure 6-2 Power up and log into the unit

1	Check that the ODU and PIDU Plus are correctly connected.
2	Connect the PC Ethernet port to the LAN port of the PIDU Plus using a standard (not crossed) Ethernet cable.
3	Apply mains or battery power to the PIDU Plus. The green Power LED should illuminate continuously.
4	After about 45 seconds, check that the orange Ethernet LED starts with 10 slow flashes.
5	Check that the Ethernet LED then illuminates continuously.

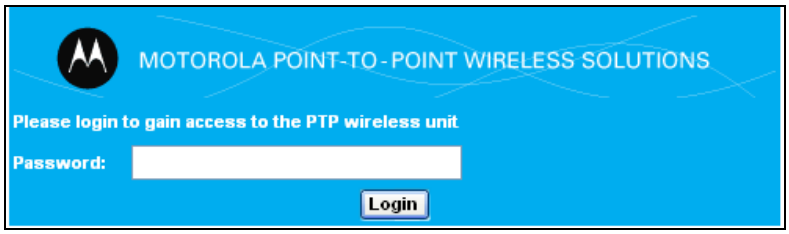
NOTE

If the Power and Ethernet LEDs do not illuminate correctly, refer to Test link end hardware on page 8-2.

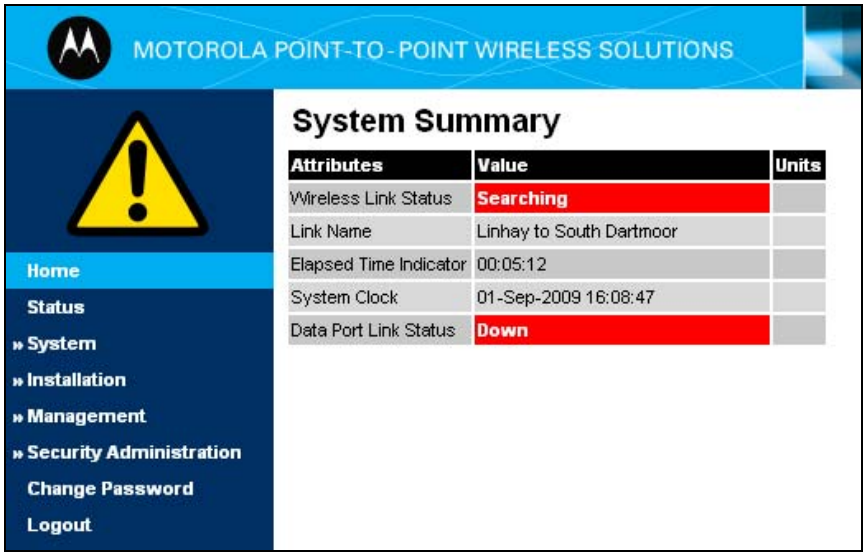
Logging into the web interface

To log into the PTP 600 web interface, proceed as follows:

Procedure 6-3 Log into the unit

1	Start the web browser from the management PC.
2	Type the IP address of the unit into the address bar, for example: 169.254.1.2.
3	Press ENTER. The login page is displayed. 

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4	Leave the Password blank and select **Login**. The web interface menu and System Summary page are displayed. 
5	Check that the PIDU Plus Ethernet LED blinks randomly as traffic passes through. 

NOTE

If the Ethernet LED does not illuminate correctly, refer to Test link end hardware on page 8-2.

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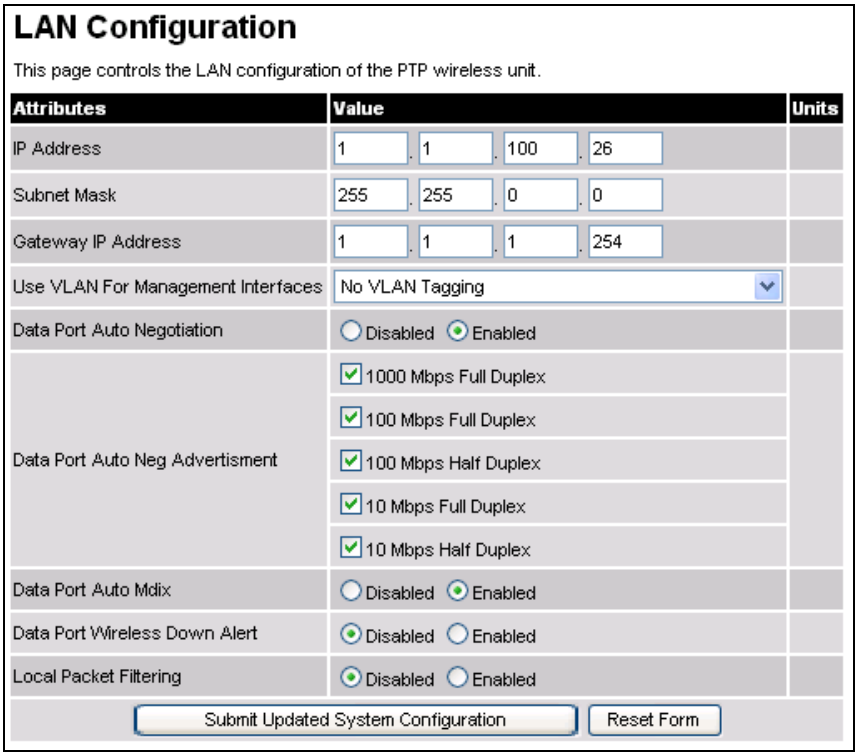
Updating the IP and Ethernet configuration

To update the IP and Ethernet configuration of the PTP 600 to meet network requirements, proceed as follows:

Procedure 6-4 Update IP and Ethernet configuration for network

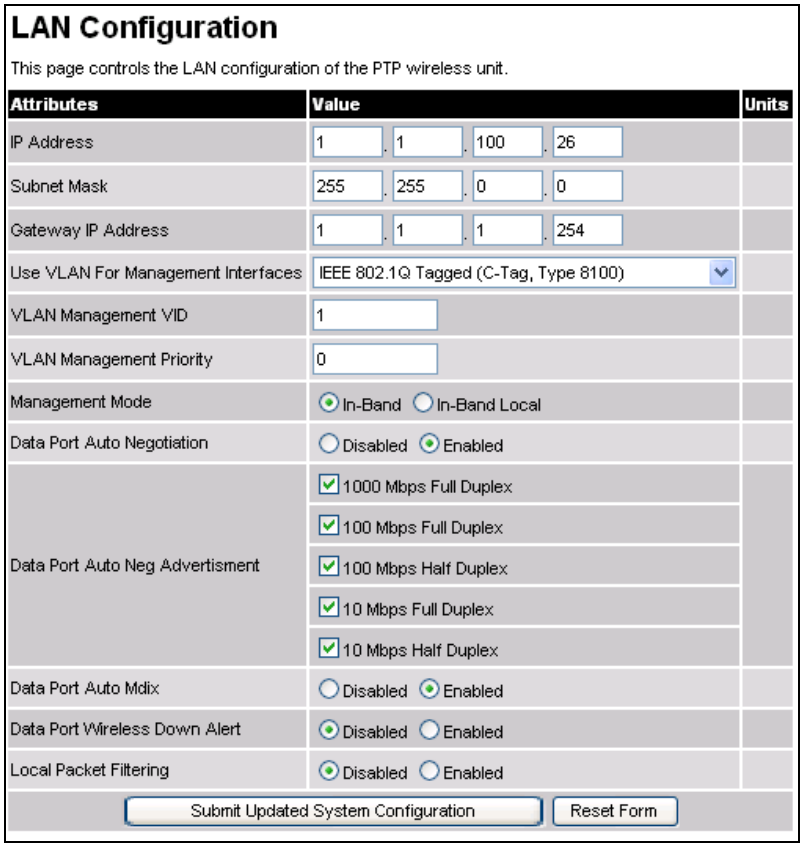
1	Select menu option **System, Configuration, LAN Configuration**. The LAN configuration page is displayed (Figure 6-3 or Figure 6-4 or Figure 6-5).
2	Update IP Address, Subnet Mask and Gateway IP Address to meet network requirements (as specified by the network administrator).
3	Review the other attributes and update them, if required (Table 6-1).
4	Select **Submit Updated System Configuration**. The reboot verification page is displayed (Figure 6-6 or Figure 6-7).
5	Select **Reboot Wireless Unit** and then **OK** to confirm the reboot.

Figure 6-3 LAN Configuration page



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Figure 6-4 LAN Configuration page with VLAN enabled



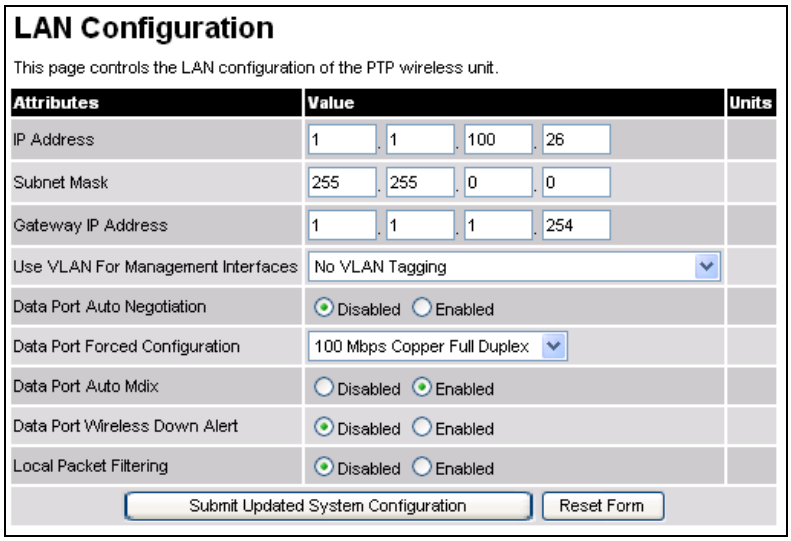
LAN Configuration

This page controls the LAN configuration of the PTP wireless unit.

Attributes	Value	Units
IP Address	1 . 1 . 100 . 26	
Subnet Mask	255 . 255 . 0 . 0	
Gateway IP Address	1 . 1 . 1 . 254	
Use VLAN For Management Interfaces	IEEE 802.1Q Tagged (C-Tag, Type 8100)	
VLAN Management VID	1	
VLAN Management Priority	0	
Management Mode	In-Band / In-Band Local	
Data Port Auto Negotiation	Disabled / Enabled	
Data Port Auto Neg Advertisment	1000 Mbps Full Duplex; 100 Mbps Full Duplex; 100 Mbps Half Duplex; 10 Mbps Full Duplex; 10 Mbps Half Duplex	
Data Port Auto Mdix	Disabled / Enabled	
Data Port Wireless Down Alert	Disabled / Enabled	
Local Packet Filtering	Disabled / Enabled	

Submit Updated System Configuration | Reset Form

Figure 6-5 LAN Configuration page with auto-negotiation disabled



LAN Configuration

This page controls the LAN configuration of the PTP wireless unit.

Attributes	Value	Units
IP Address	1 . 1 . 100 . 26	
Subnet Mask	255 . 255 . 0 . 0	
Gateway IP Address	1 . 1 . 1 . 254	
Use VLAN For Management Interfaces	No VLAN Tagging	
Data Port Auto Negotiation	Disabled / Enabled	
Data Port Forced Configuration	100 Mbps Copper Full Duplex	
Data Port Auto Mdix	Disabled / Enabled	
Data Port Wireless Down Alert	Disabled / Enabled	
Local Packet Filtering	Disabled / Enabled	

Submit Updated System Configuration | Reset Form

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Table 6-1 LAN Configuration attributes

Attribute	Meaning
IP Address	Internet protocol (IP) address. This address is used by the family of Internet protocols to uniquely identify this unit on a network.
Subnet Mask	Defines the address range of the connected IP network.
Gateway IP Address	The IP address of a computer on the current network that acts as a gateway. A gateway acts as an entrance and exit to packets from and to other networks.
Use VLAN For Management Interfaces	This controls whether or not the management interfaces (WWW/SNMP/SMTP/SNTP) use VLAN tags. **⚠ CAUTION** Ensure that the configured VLAN is accessible, otherwise it will not be possible to access the unit following the next reboot. The PTP 600 management function is only compatible with single VLAN tagged packets. Any management packet with two or more packets will be ignored.
VLAN Management VID	Only displayed when 'Use VLAN for Management Interfaces' is enabled (Figure 6-4). Enter the VLAN VID (range 0 to 4094) that will be included in Ethernet frames generated by the management interfaces.
VLAN Management Priority	Only displayed when 'Use VLAN for Management Interfaces' is enabled (Figure 6-4). Enter the VLAN priority (range 0 to 7) that will be included in Ethernet frames generated by the management interfaces.

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Attribute	Meaning
Management Mode	Only displayed when Use VLAN for Management Interfaces is enabled (Figure 6-4). 'In-Band' means that the web interface can be reached from the data port at both the local and remote ODUs (assuming that the wireless link is established). 'In-Band Local' means that the web interface can be reached from the data port at the local ODU only. If this is selected, ensure that the same VLAN Management VID is configured at both ends of the link.
Data Port Auto Negotiation	'Enabled' means that configuration is automatically negotiated. This is the default setting. 'Disabled' means that configuration is forced. Use the same setting for both ends of the link. When Data Port Auto Negotiation is Disabled, the format of the LAN configuration page changes (Figure 6-5). The configuration should only be forced if problems are experienced with auto-negotiation. **NOTE** Instead of forcing configuration, the IEEE802.3 specification recommends enabling Auto Negotiation with only the specific ability or abilities advertised.
Data Port Forced Configuration	Only displayed when Data Port Auto Negotiation is disabled (Figure 6-5). This forces the speed and duplex setting of the Ethernet interface. Over the air throughput will be capped to the rate of the Ethernet interface at the receiving end of the link. Use the same setting for both ends of the link. **CAUTION** The same configuration must be forced on connected network equipment, otherwise a duplex mismatch will occur and data throughput will be greatly reduced.

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Attribute	Meaning
Data Port Auto Neg Advertisement	Select the data rate that the auto-negotiation mechanism will advertise as available. Use the same setting for both ends of the link. Only select a data rate that is within the capability of connected network equipment, otherwise loss of service may occur.
Data Port Auto Mdix	This enables/disables the Auto Medium Dependent Interface (MDI)/Medium Dependent Interface Crossover (MDIX) capability. Default is 'Enabled'.
Data Port Wireless Down Alert	When enabled, this causes the Ethernet link to be dropped briefly when the wireless link drops. This signals to the connected network equipment that this link is no longer available. Connected Ethernet switches can be configured to forward Ethernet frames on an alternative path identified using the Spanning Tree Protocol (STP).
Local Packet Filtering	'Enabled' means that the management agent learns the location of end stations from the source addresses in received management frames. The agent filters transmitted management frames to ensure that the frame is transmitted at the Ethernet port, or over the wireless link as appropriate. If the end station address is unknown, then management traffic is transmitted at the Ethernet port and over the wireless link. 'Disabled' means that ALL Ethernet packets received are transmitted over the wireless link. Local Packet Filtering should be disabled when external Ethernet switching hardware or a router is present.

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Figure 6-6 Configuration Reboot page

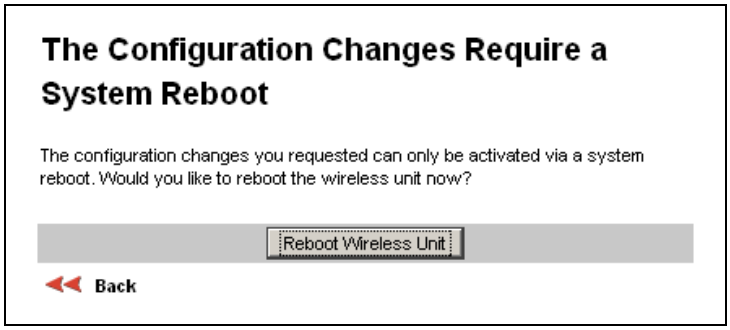
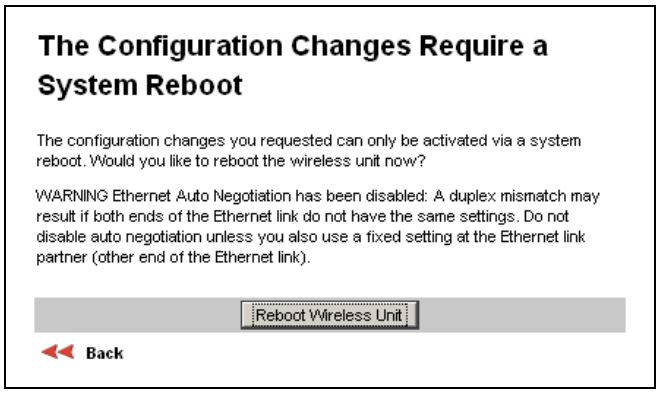


Figure 6-7 Configuration Reboot page - Ethernet auto negotiation disabled



Reconnecting to the management PC

If the IP Address, Subnet Mask and Gateway IP Address of the unit have been updated to meet network requirements, then reconfigure the local management PC to use an IP address that is valid for the network. Refer to Configuring the management PC on page 6-2.

When the unit has rebooted, log in using the new IP address. Refer to Logging into the web interface on page 6-4.

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Task 2: Install license keys

This task consists of the following procedures:

- Checking licensed capabilities on page 6-12
- Generating a new license key on page 6-14
- Entering a new license key on page 6-15

Some PTP 600 products are supplied with two license keys: one installed at the factory and one alternative key.

Checking licensed capabilities

To check that the capabilities of the installed license key meet the operator's requirements, proceed as follows:

Procedure 6-5 Check capability summary

1	Select menu option **System, License Key.** The Software License Key page is displayed (Figure 6-8).
2	Check the attributes in the Capability summary section (Table 6-2), in particular: Region Code must be correct. If FIPS 140-2 capability is required, ensure that the FIPS Security Level is set to 'FIPS'. If encryption is required, ensure that the Encryption Algorithm setting is correct.
3	If the region code in the installed license key is incorrect, install the alternative license key as described in Entering a new license key on page 6-15 and check its capabilities.
4	If the available license keys do not have the required capabilities, then determine the new requirements and refer to Generating a new license key on page 6-14.

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Figure 6-8 Software License Key page

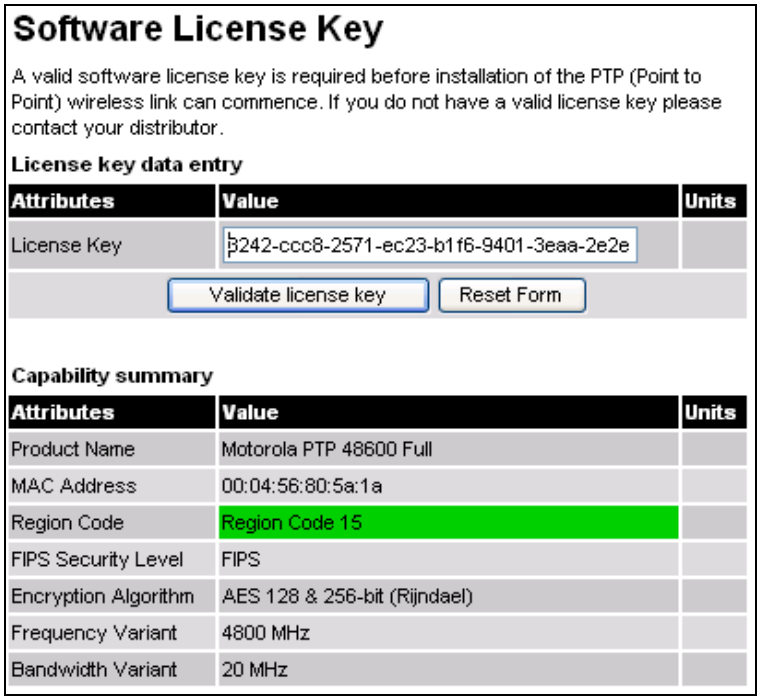


Table 6-2 Capability summary attributes

Attribute	Meaning
Product Name	The name of the PTP 600 product variant.
MAC Address	The MAC address of the PTP 600.
Region Code	The region code prohibits the wireless unit from operating outside the regulated limits. An invalid region code indicates a corrupted license key.
FIPS Security Level	The maximum configurable security level.
Encryption Algorithm	The encryption algorithms available for use at the wireless interface of the ODU. Encryption algorithm and keys must be the same at BOTH ends of the link for it to function correctly. This attribute is only displayed if the current license key permits encryption.
Frequency Variant	Frequency variant of the wireless unit.
Bandwidth Variant	Bandwidth variant of the wireless unit.

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Generating a new license key

To generate a new license key to activate new licensed capabilities (for example Region Code, FIPS Security Level or Encryption Algorithm), proceed as follows:

Procedure 6-6 Use an access key to generate a license key

1	Purchase the required new capabilities from the Motorola authorized Point-To-Point dealer who supplied the PTP 600 link. The dealer will supply one or more access keys.
2	Go to the PTP web support page at http://www.motorola.com/ptp/support and select **Key Generator**. The PTP License Key Generator form should be displayed.
3	Enter the required details, including the access keys supplied by the dealer.
4	Submit the web form. The PTP License Key Generator will respond with the new license key.

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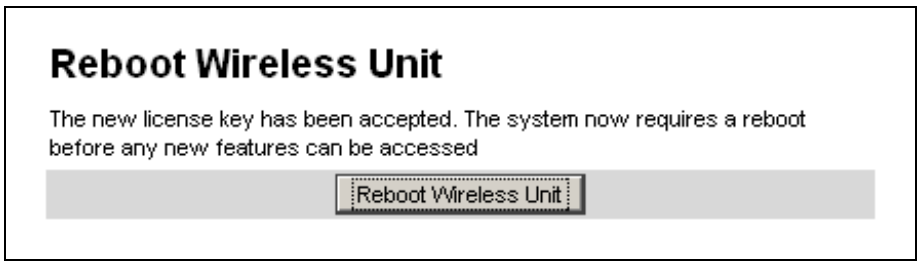
Entering a new license key

To upgrade the unit to a new license key, proceed as follows:

Procedure 6-7 Upgrade unit to a new license key

1	Select menu option **System, License Key**. The Software License Key page is displayed (Figure 6-8).
2	Enter the new License Key.
3	Select **Validate license key**. If the license key is valid, the Reboot Wireless Unit dialog is displayed (Figure 6-9).
4	Select **Reboot Wireless Unit** and select **OK** to confirm.
5	On completion, the unit restarts with the new license key.

Figure 6-9 Reboot Wireless Unit dialog



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Task 3: Upgrade software version

This task consists of the following procedures:

- Checking the installed software version on page 6-16
- Saving the system configuration on page 6-17
- Upgrading to a new software version on page 6-18

⚠ CAUTION

Ensure that the correct units are upgraded, as units cannot easily be downgraded afterwards.

If the link is operational, ensure that the remote end of the link is upgraded first using the wireless connection, and then the local end can be upgraded. Otherwise, the remote end may not be accessible.

Checking the installed software version

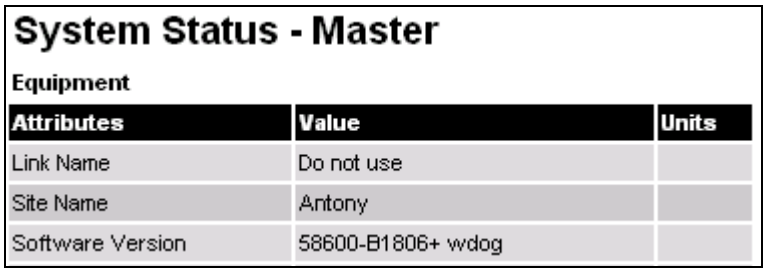
To check the installed software version, proceed as follows:

Procedure 6-8 Check software version

1	Select menu option **Status**. The System Status page is displayed. Software Version is near the top (Figure 6-10).
2	If FIPS capability is required, check that the installed software is FIPS validated, as indicated by a `FIPS-` prefix to the Software Version, for example: `FIPS-PTP600-09-01`
3	Go to http://www.motorola.com/ptp/support and find Point-to-Point software updates. Check that the latest PTP 600 software version (for example 600-09-01) is the same as the installed Software Version.
4	If the software needs to be upgraded, either to the latest version or to a FIPS capable version, perform Saving the system configuration on page 6-17 and Upgrading to a new software version on page 6-18.

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Figure 6-10 Software Version in System Status page



Saving the system configuration

To save the current configuration before upgrading to a new software version, proceed as follows:

Procedure 6-9 Save configuration file

1	Select menu option **System, Configuration**, **Save And Restore**. The Save & Restore Configuration page is displayed (Figure 6-11).
2	Select **Save Configuration File**.
3	Save the configuration file to a PC hard drive.

The configuration file format is:

MAC-mm-mm-mm_IP-iii-iii-iii-iii.cfg

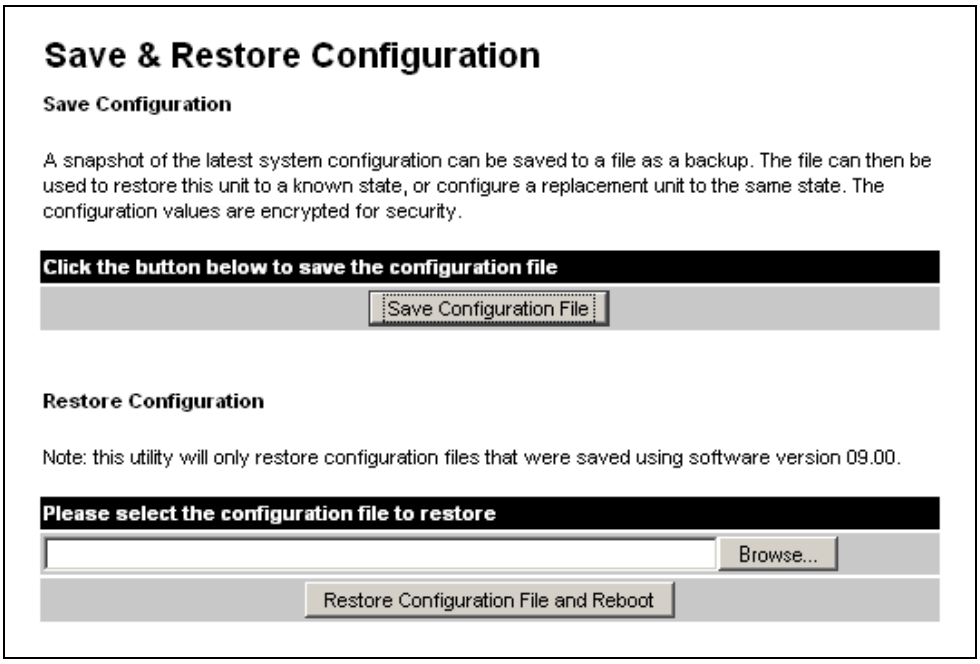
Where:	**Is:**
mm-mm-mm	MAC address of unit
iii-iii-iii-iii	IP address of unit.

NOTE

Internet Explorer inspects the content of any downloadable file and decides whether to treat the file as ASCII or binary. As a result of this feature, Internet Explorer always treats the configuration file as ASCII and attempts to display it instead of downloading it. Firefox makes no such assumption.

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Figure 6-11 Save & Restore Configuration page



Upgrading to a new software version

Before performing a software upgrade, save the configuration as described in Saving the system configuration on page 6-17.

To upgrade to a new software version, proceed as follows:

Procedure 6-10 Upgrade software version

1	Go to http://www.motorola.com/ptp/support and find Point-to-Point software updates. Download and save the required software image (for example `PTP600-09-01.DLD2` or `FIPS-PTP600-09-01.DLD2`).
2	Select menu option **System, Software Upgrade**. The Software Upgrade page is displayed (Figure 6-12).
3	Select **Browse**. Navigate to the folder containing the downloaded software image and select **Open**.

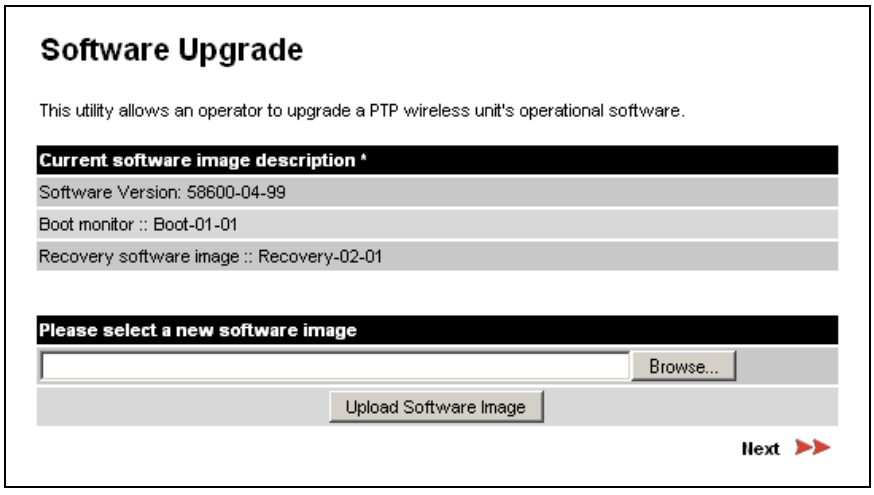
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4	Select **Upload Software Image**. The Software Upgrade Confirmation page is displayed (Figure 6-13). If the upgrade is taking the ODU into or out of FIPS mode, an additional warning is displayed stating that the upgrade will cause automatic erasure of the critical security parameters (CSPs).
5	Select **Program Software Image into Non-Volatile Memory**. The Progress Tracker page is displayed (Figure 6-14). **⚠ CAUTION** The upgrade process should not be interrupted, as this can result in a corrupt main software image, which will result in the recovery image being booted at the next reset cycle.
6	On completion, the Software Upgrade Complete page is displayed (Figure 6-15). Select **Reboot Wireless Unit** and select **OK** to confirm. The unit begins the reboot process.
7	The reboot process will take up to 120 seconds. During this time it will not be possible to communicate with the unit. After the reboot, check that the required software image is loaded and running.

NOTE

If communication with the unit is not restored after 120 seconds , this could indicate a problem with the memory update process. If this happens, enter Recovery Mode as described in Using recovery mode on page 8-21.

Figure 6-12 Software Upgrade page



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Figure 6-13 Software Upgrade Confirmation page

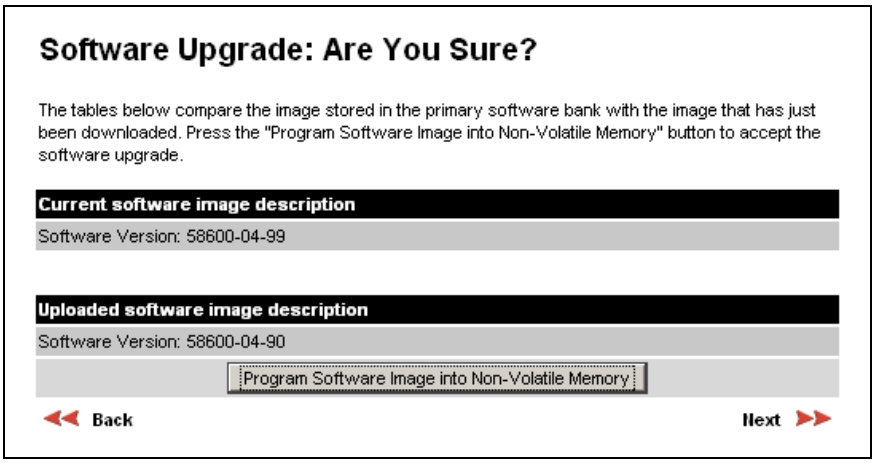


Figure 6-14 Upgrade Progress Tracker page

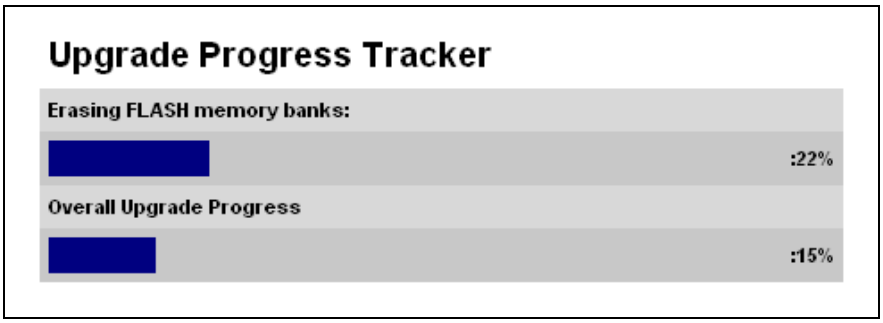
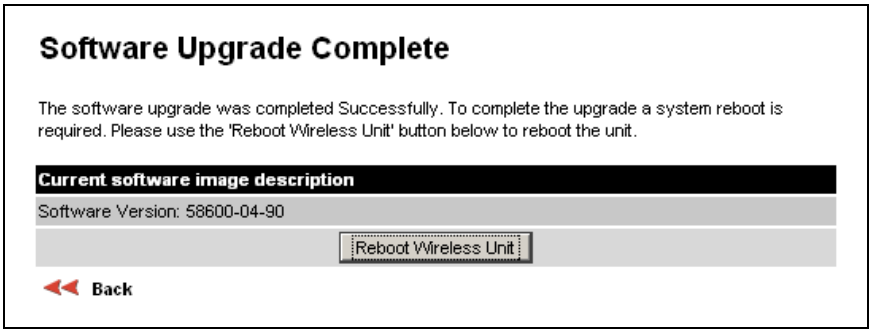


Figure 6-15 Software Upgrade Complete page



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Task 4: Configure security

This task is only performed when the PTP 600 link requires AES encryption or HTTPS/TLS security (including FIPS 140-2 if appropriate).

Depending upon network security requirements, choose one of the following procedures:

- If AES encryption alone is required, perform Configuring AES encryption on page 6-22.
- If higher levels of security are required, including FIPS 140-2 if appropriate, perform Configuring HTTPS/TLS on page 6-24.

⚠ CAUTION

Before connecting the PTP 600 to the network, ensure that access to the web-based management interface is controlled in accordance with the network operator's security policy.

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Configuring AES encryption

AES link encryption is only available to users who have purchased an appropriate license key. Refer to Task 2: Install license keys on page 6-12.

To configure AES link encryption on a unit that is not yet in a wireless link, proceed as follows:

Procedure 6-11 Configure AES link encryption on an unlinked unit

1	Select menu option **System, Configuration**. The System Configuration page is displayed (Figure 6-16).
2	Select the Encryption Algorithm, either 'AES 128-bit' or 'AES 256-bit'. The same algorithm must be used at both ends of the link.
3	Enter and confirm the encryption key. The key consists of 32 or 64 case insensitive hexadecimal characters. The same key must be used at both ends of the link.
4	Select **Submit Updated System Configuration**. The reboot confirmation dialog is displayed (Figure 6-17).
6	Select **Reboot Wireless Unit**.

NOTE

To enable AES encryption over an established link: open two browsers, log into the web interfaces at each end of the link, perform the above procedure at each unit, then reboot both ends of the link. The software is designed to allow five seconds so that a user can command both ends of the link to reboot before the wireless link drops.

CAUTION

Configuring link encryption over an established link will necessitate a service outage. Therefore, the configuration process should be scheduled during a period of low link utilization.

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Figure 6-16 System Configuration page

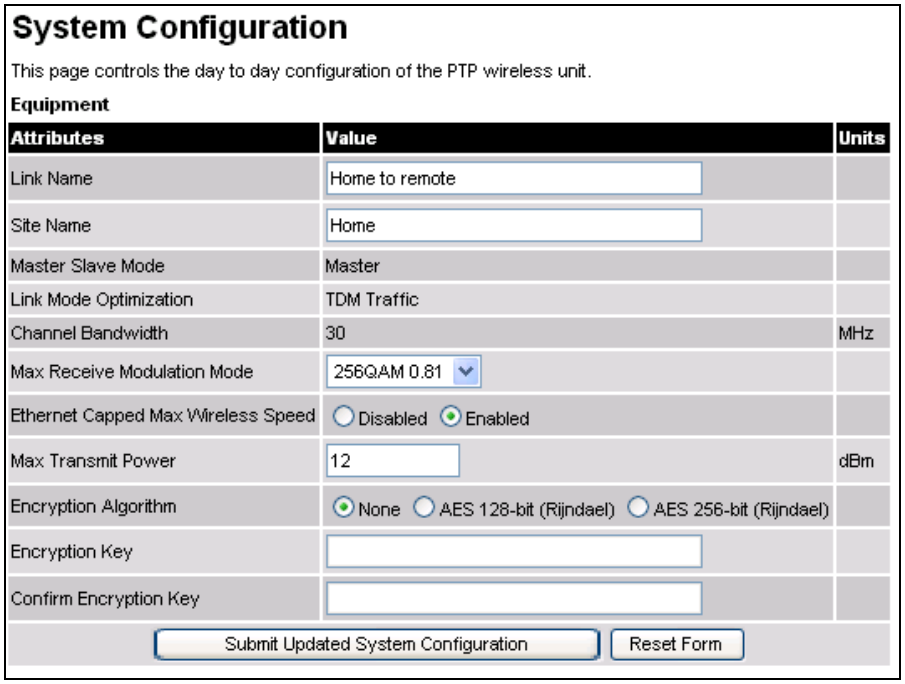
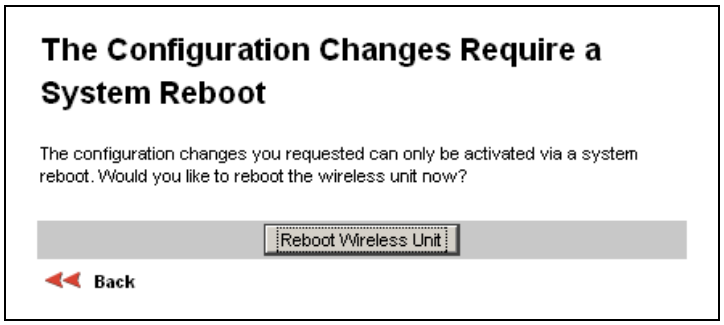


Figure 6-17 Configuration Reboot dialog



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Configuring HTTPS/TLS

Perform this task to review and configure HTTPS/TLS security related parameters. If the unit is required to operate in FIPS 140-2 secure mode, observe the additional requirements as described.

Prerequisites for HTTPS/TLS

The Security Wizard is only available when both of the following conditions are true:

- The wireless unit has a license key with either 128-bit or 256-bit AES link encryption enabled,
- AND:
    - EITHER: identity-based user accounts are disabled,
    - OR: identity-based user accounts are enabled and the user's role is Security Officer.

If these conditions are not both true, the Current Security Summary page prevents execution of the wizard.

Before running the Security Wizard, decide which of the following attributes require updating and obtain new values:

- Key of Keys
- TLS Private Key and Public Certificates
- User Defined Security Banner
- Entropy Input
- Wireless Link Encryption Key for AES
- Port numbers for HTTP, HTTPS and Telnet

For more information on these attributes, refer to Planning for HTTPS/TLS operation on page 2-37.

NOTE

The security certificates are associated with the IP address. Ensure that the correct IP address has been configured before setting up HTTPS/TLS.

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Prerequisites for FIPS 140-2

If the unit is required to operate in FIPS 140-2 secure mode, perform these checks before starting the Security Wizard. For more information on FIPS 140-2 secure mode, refer to FIPS 140-2 on page 1-56.

Ensure that the following cryptographic material has been generated using a FIPS-approved cryptographic generator:

- Key Of Keys
- TLS Private Key and Public Certificates
- Entropy Input
- Wireless Link Encryption Key for AES

Ensure that the web browsers used are enabled for HTTPS/TLS operation using FIPS-approved cipher specifications.

To check that the unit is capable of supporting FIPS 140-2 operation, proceed as follows:

Procedure 6-12 Check for FIPS 140-2 capability

1	Check that the hardware is capable of supporting FIPS 140-2. This includes checking the silver tamper-evident labels, the hardware platform part number and the the hardware version. For more information, refer to Hardware security on page 1-56.
2	If the hardware does not support FIPS 140-2, apply the hardware security upgrade kit.
3	Check the capability summary in the Software License Key page to ensure that the current license key supports AES and FIPS 140-2. If necessary, obtain an access key and generate a new license key. For more information, refer to Task 2: Install license keys on page 6-12.
4	Check the installed software version in the System Status page to ensure that the software image is FIPS validated. If necessary, upgrade to the latest FIPS validated image. For more information, refer to Task 3: Upgrade software version on page 6-16.
5	To confirm that all of the above steps have been completed, check that the FIPS 140-2 Validated logo is displayed in the Navigation Bar. For more information, refer to Indication of FIPS 140-2 capability on page 1-58.

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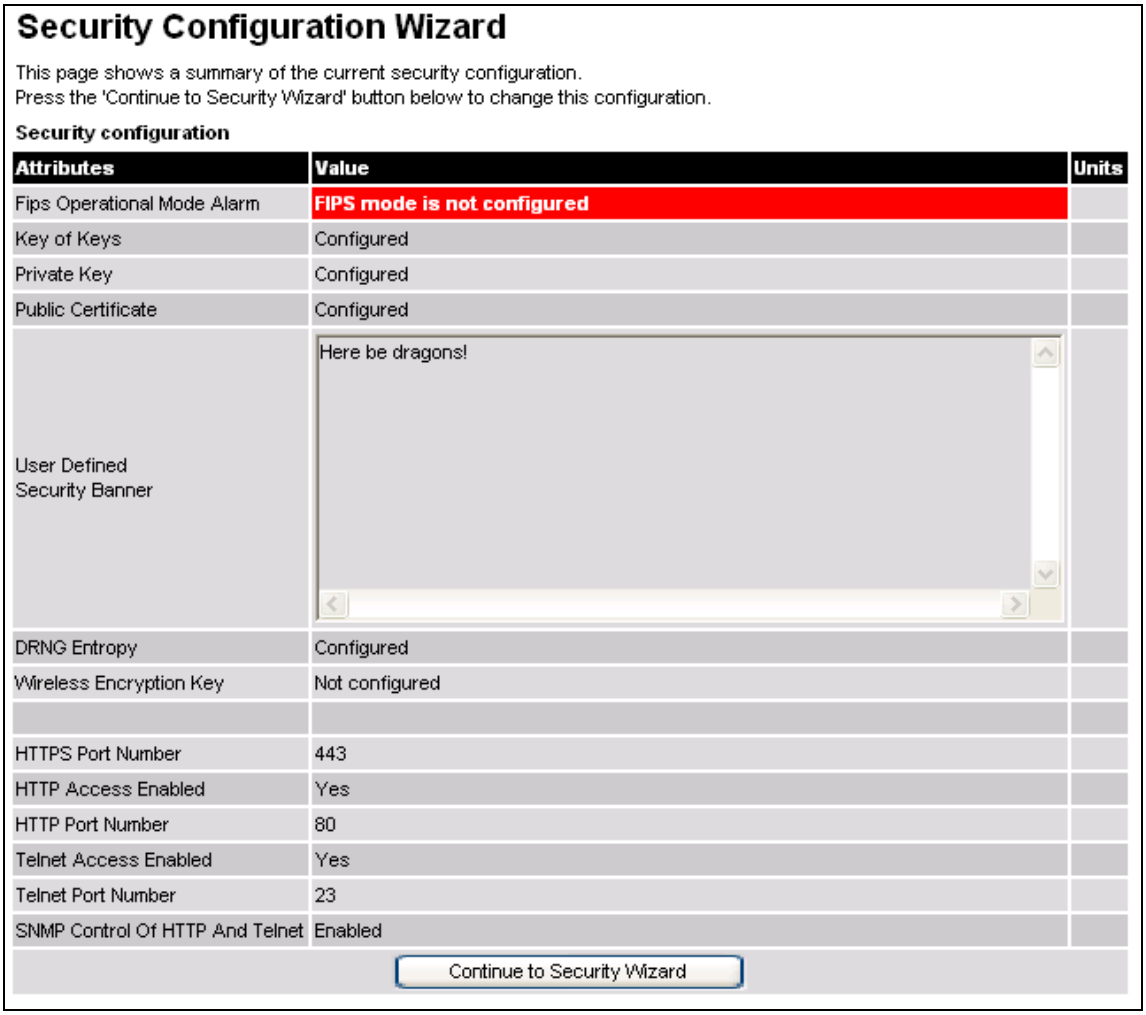
Starting security wizard

To review HTTPS/TLS security related parameters, proceed as follows:

Procedure 6-13 HTTPS/TLS using the Security Wizard

1	Select menu option **Security**. The Security Configuration Wizard page is displayed (Figure 6-18).
2	Review the summary.
3	If any updates are required, select **Continue to Security Wizard**.

Figure 6-18 Security Configuration Wizard page



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Step 1: Enter key of keys

The PTP 600 uses a key of keys approach to encrypt all critical security parameters (CSPs). Erasing of the keys of keys will render all CSPs inaccessible.

NOTE

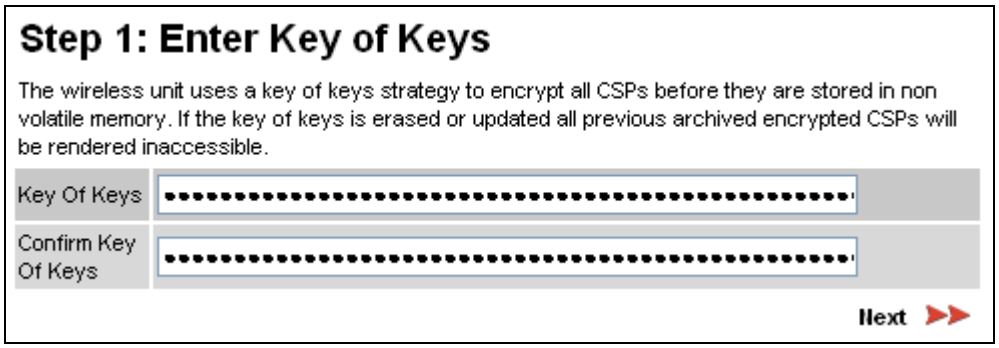
If the unit is required to operate in FIPS 140-2 secure mode, the Key Of Keys must be entered.

To enter the Key Of Keys via the Security Wizard, proceed as follows:

Procedure 6-14 Enter the key of keys

1	The Step 1: Enter Key of Keys page is displayed (Figure 6-19).
2	Enter the generated key of keys in both the Key Of Keys and Confirm Key Of Keys fields. If the two values are not identical, an error message is displayed.
3	Select **Next**.

Figure 6-19 Step 1: Enter Key of Keys page



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Step 2: TLS private key and public certificate

CAUTION

If the certificates expire, the unit will be unreachable. If this occurs, put the unit into recovery mode and erase all configuration. For more information, refer to Using recovery mode on page 8-21.

NOTE

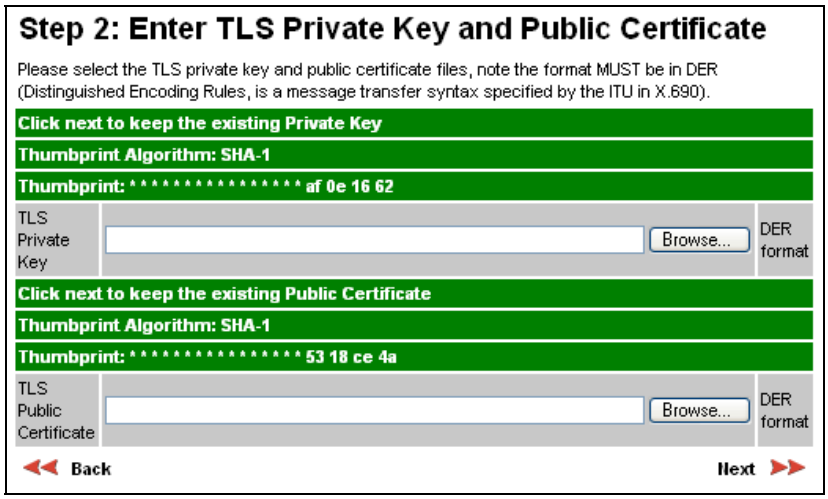
If the unit is required to operate in FIPS 140-2 secure mode, ensure that the TLS Private Key and Public Certificate are generated using a FIPS-approved cryptographic generator.

To enter the TLS Private Key and Public Certificate via the Security Wizard, proceed as follows:

Procedure 6-15 Enter TLS private key and public certificate

1	The Step 2: TLS Private Key and Public Certificate page is displayed (Figure 6-20).
2	If a valid TLS private key exists, then an SHA-1 thumbprint of the key is displayed. If this key is correct, then take no action. Otherwise, select **Browse** and select the generated private key file (.der).
3	If a valid TLS public certificate exists, then an SHA-1 thumbprint of the certificate is displayed. If this certificate is correct, then take no action. Otherwise, select **Browse** and select the generated certificate file (.der).
4	Select **Next**.

Figure 6-20 Step 2: TLS Private Key and Public Certificate page



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Step 3: User security banner

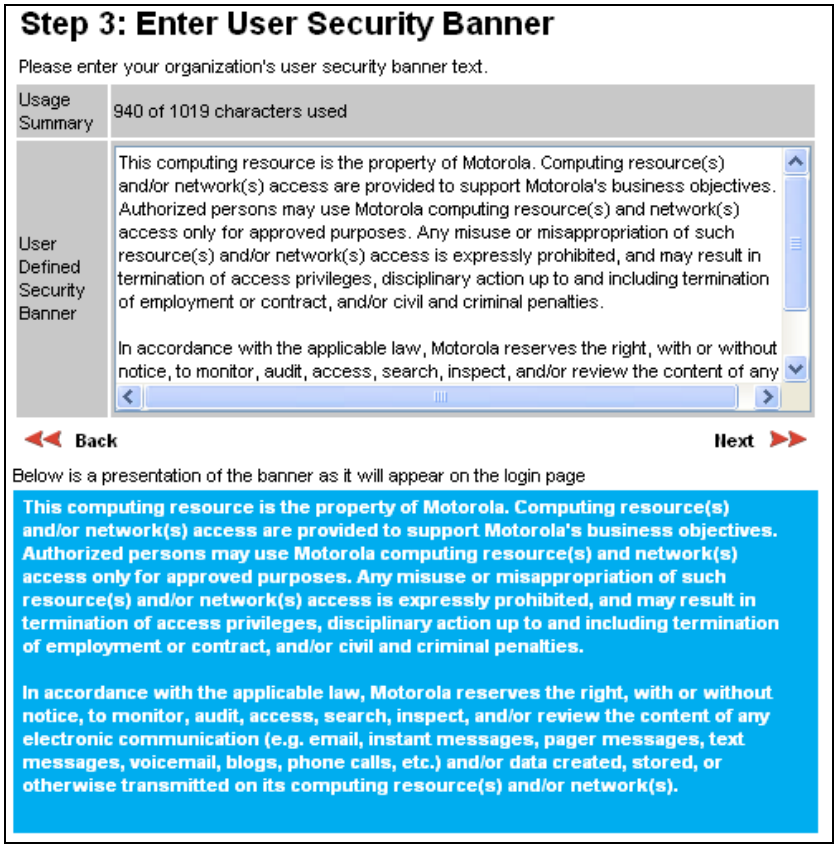
The user security banner is displayed every time a user attempts to login to the wireless unit.

To enter the user security banner via the Security Wizard, proceed as follows:

Procedure 6-16 Enter user security banner

1	The Step 3: User Security Banner page is displayed (Figure 6-21).
2	Update the User Defined Security Banner field.
3	Select **Next**.

Figure 6-21 Step 3: User Security Banner page



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Step 4: Random number entropy input

The entropy input is used to seed the TLS random number generator . Generate the entropy input using a random number generator.

NOTE

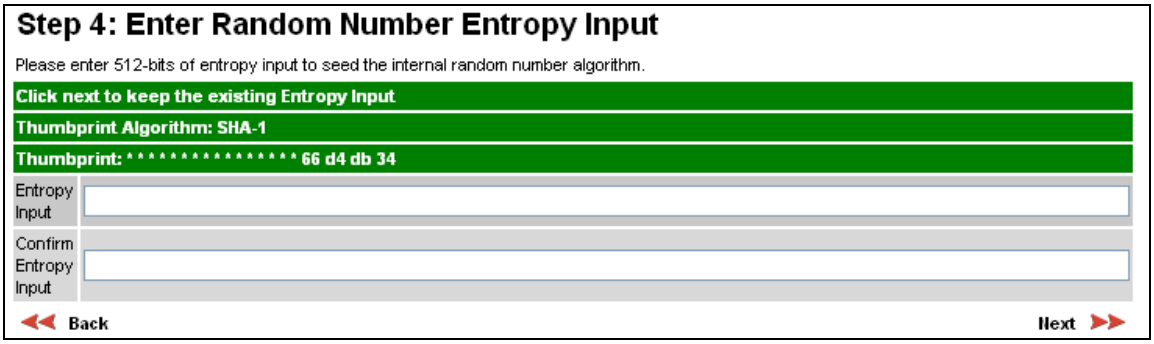
If the unit is required to operate in FIPS 140-2 secure mode, ensure that the Entropy Input is generated using a FIPS-approved cryptographic generator.

To enter the Entropy Input via the Security Wizard, proceed as follows:

Procedure 6-17 Enter random number entropy input

1	The Step 4: Random Number Entropy Input page is displayed (Figure 6-22).
2	If valid entropy input exists, then an SHA-1 thumbprint of the input is displayed. If this input is correct, then take no action. Otherwise, enter the generated input in the Entropy Input and Confirm Entropy Input fields. If the two values are not identical, an error message is displayed.
3	Select **Next**.

Figure 6-22 Step 4: Random Number Entropy Input page



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Step 5: Enter the wireless link encryption key

The wireless link encryption key is used to encrypt all traffic over the PTP600 wireless link.

NOTE

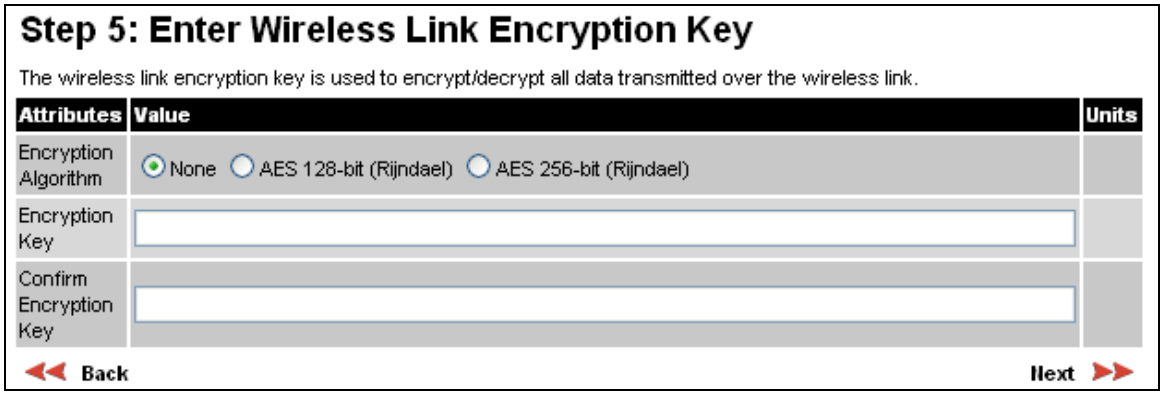
If the unit is required to operate in FIPS 140-2 secure mode, Encryption Algorithm and Encryption Key must be entered.

To enter the wireless link encryption key via the Security Wizard, proceed as follows:

Procedure 6-18 Enter wireless link encryption key

1	The Step 5: Enter The Wireless Link Encryption Key page is displayed (Figure 6-23).
2	Select the applicable value in the Encryption Algorithm field.
3	If a valid encryption key exists, then an SHA-1 thumbprint of the key is displayed. If this key is correct, then take no action. Otherwise, enter the generated key in the Wireless Link Encryption Key and Confirm Wireless Link Encryption Key fields. If the two values are not identical, an error message is displayed.
4	Select **Next**.

Figure 6-23 Step 5: Enter The Wireless Link Encryption Key page



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Step 6: HTTP and Telnet settings

The PTP 600 can be remotely managed in four ways: HTTPS, HTTP, Telnet or SNMP.

NOTE

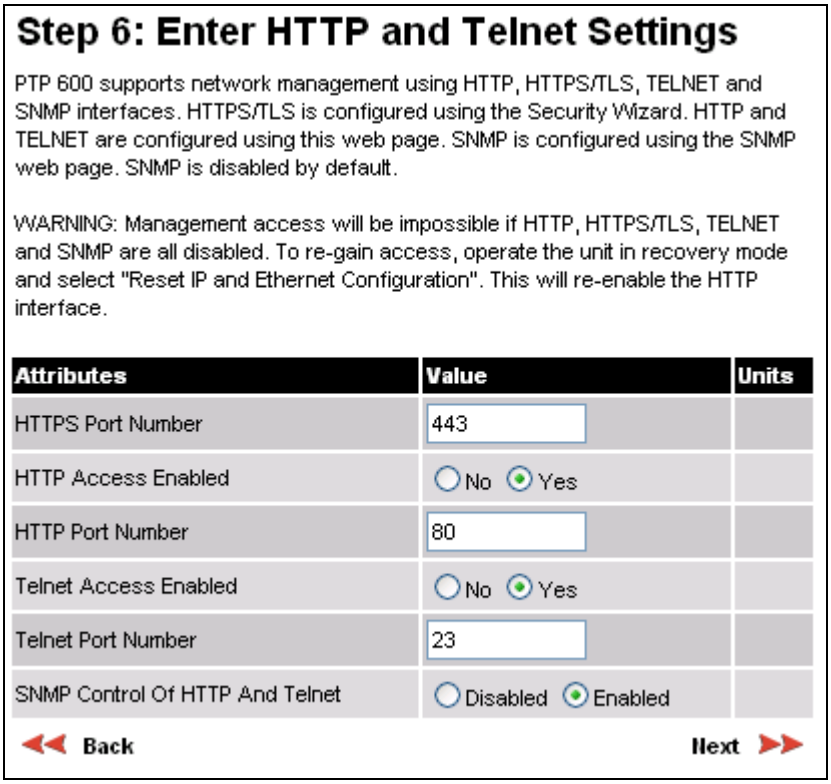
If the unit is required to operate in FIPS 140-2 secure mode, HTTP, Telnet and SNMP Control must all be disabled.

To configure HTTP and Telnet via the Security Wizard, proceed as follows:

Procedure 6-19 Configure HTTP and Telnet

1	The Step 6: HTTP and Telnet Settings page is displayed (Figure 6-24).
2	Review and update the HTTP and Telnet attributes (Table 6-3).
3	Select **Next**.

Figure 6-24 Step 6: HTTP and Telnet Settings page



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Table 6-3 HTTP and Telnet attributes

Attribute	Meaning
HTTPS Port Number	The port number for HTTPS access. A value of zero means the wireless unit uses the default port. **NOTE** HTTPS access is controlled by license key.
HTTP Access Enabled	'No' means that the unit will not respond to any requests on the HTTP port. 'Yes' means that the unit will respond to requests on the HTTP port. Remote management via HTTPS is not affected by this setting.
HTTP Port Number	The port number for HTTP access. A value of zero means the wireless unit uses the default port.
Telnet Access Enabled	'No' means that the unit will not respond to any requests on the Telnet port. 'Yes' means that the unit will respond to requests on the Telnet port.
Telnet Port Number	The port number for Telnet access. A value of zero means the wireless unit uses the default port.
SNMP Control of HTTP And Telnet	'Disabled' means that neither HTTP nor Telnet can be controlled remotely via SNMP. 'Enabled' means that both HTTP and Telnet can be controlled remotely via SNMP.

NOTE

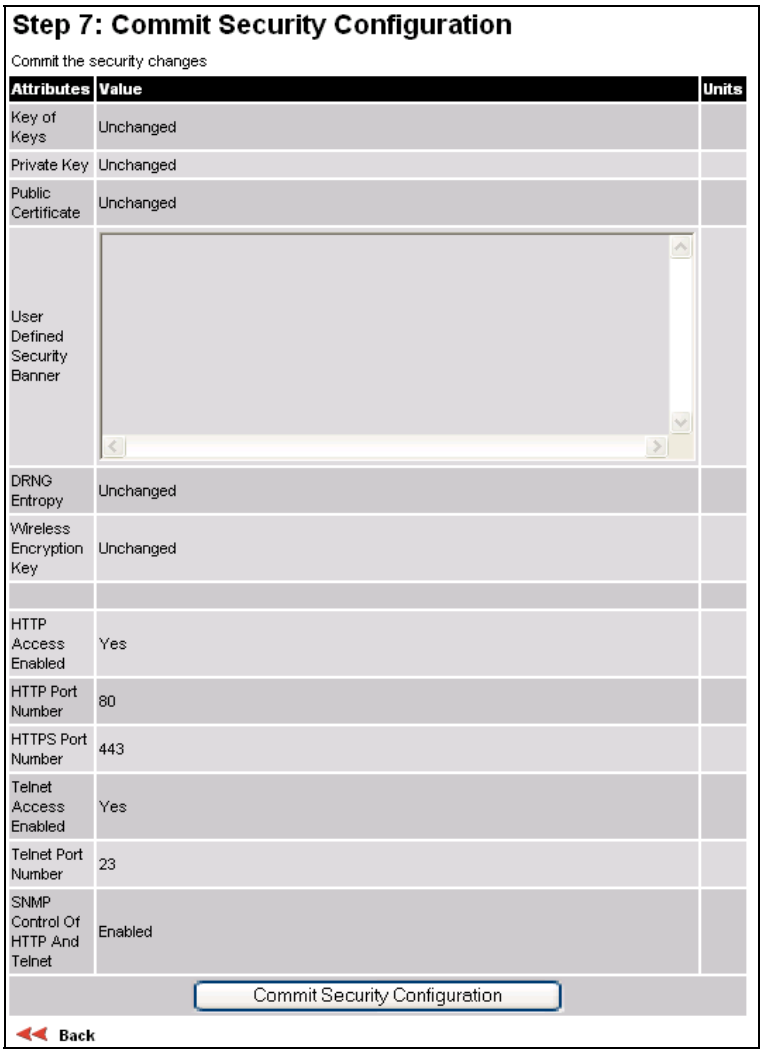
If HTTP, Telnet and SNMP are all disabled (as required for FIPS 140-2 mode), the secure web server becomes the only management tool for the ODU web interface. To reenter the web interface after Step 7 of the Security Wizard, use the URL **https://aa.bb.cc.dd** (where aa.bb.cc.dd is the IP address of the unit).

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Step 7: Commit security configuration

Review all changes that have been made in the Security Wizard (Figure 6-25). To ensure that the changes take effect, select **Commit Security Configuration**. The unit reboots and the changes take effect.

Figure 6-25 Step 7: Commit Security Configuration page



NOTE

If the Key of keys is entered or modified in the Security Wizard, user accounts are reset when **Commit Security Configuration** is selected. It is then necessary to reconfigure them.

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Checking that the unit is in FIPS 140-2 secure mode

The unit is ready to operate in FIPS 140-2 secure mode when both of the following conditions apply:

- The FIPS 140-2 capability logo is displayed in the navigation bar (Figure 1-25).
- The FIPS Operational Mode Alarm is not present in the Home page (Figure 1-26).

If the FIPS 140-2 capability logo is not displayed in the navigation bar, then return to Prerequisites for FIPS 140-2 on page 6-25 and check that all prerequisites are fulfilled.

If the FIPS 140-2 Operational Mode Alarm is present in the Home page, take action depending upon the alarm setting as follows:

- 'FIPS mode is not configured' – return to Starting security wizard on page 6-26 and check that all Security Wizard settings are correct for FIPS 140-2.
- 'FIPS mode is configured, but not active' – return to Step 6: HTTP and Telnet settings on page 6-32 and set the following attributes to 'No':
    - HTTP Access Enabled
    - Telnet Access Enabled
    - SNMP Control of HTTP And Telnet

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Task 5: Configure password policy

This task consists of the following procedures:

- Configuring user accounts on page 6-36
- Configuring password complexity on page 6-39

Configuring user accounts

Perform this task to ensure that user access to the web-based management interface is controlled in accordance with the network operator's security policy.

NOTE

If the unit is required to operate in FIPS 140-2 secure mode, the following user account options must be enabled:

- Auto Logout Period
- Maximum Number of Login Attempts
- Login Attempt Lockout Period
- Minimum Password Change Period
- Password Expiry Period
- Webpage Session Control
- Identity Based User Accounts
- Password Expiry Action

If identity-based user accounts are enabled, this task may only be performed by a Security Officer.

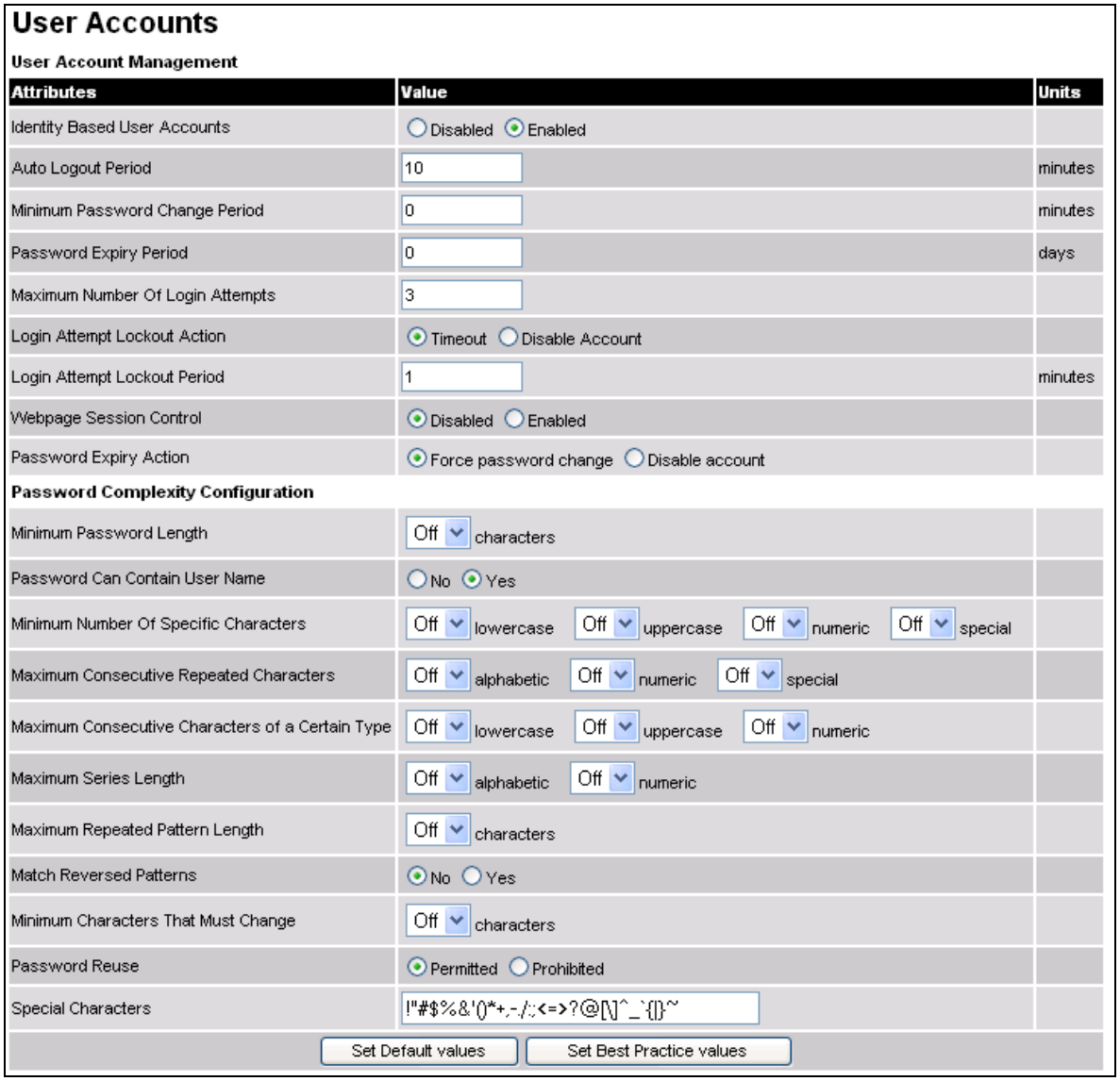
To set user account options, proceed as follows:

Procedure 6-20 Configure user accounts

1	Select menu option **Management, Web, Local User Accounts**. The User Accounts page is displayed (Figure 6-26).
2	Review and update the User Account Management attributes (Table 6-4).
3	If any attributes have been updated, select **Submit User Account Updates**.

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Figure 6-26 User Accounts page (identity-based user accounts not shown)



User Accounts

User Account Management

Attributes	Value	Units
Identity Based User Accounts	○ Disabled ◉ Enabled	
Auto Logout Period	10	minutes
Minimum Password Change Period	0	minutes
Password Expiry Period	0	days
Maximum Number Of Login Attempts	3	
Login Attempt Lockout Action	◉ Timeout ○ Disable Account	
Login Attempt Lockout Period	1	minutes
Webpage Session Control	◉ Disabled ○ Enabled	
Password Expiry Action	◉ Force password change ○ Disable account	
Password Complexity Configuration		
Minimum Password Length	Off characters	
Password Can Contain User Name	○ No ◉ Yes	
Minimum Number Of Specific Characters	Off lowercase Off uppercase Off numeric Off special	
Maximum Consecutive Repeated Characters	Off alphabetic Off numeric Off special	
Maximum Consecutive Characters of a Certain Type	Off lowercase Off uppercase Off numeric	
Maximum Series Length	Off alphabetic Off numeric	
Maximum Repeated Pattern Length	Off characters	
Match Reversed Patterns	◉ No ○ Yes	
Minimum Characters That Must Change	Off characters	
Password Reuse	◉ Permitted ○ Prohibited	
Special Characters	!"#$%&'()*+,-./:;<=>?@[\]^_`{|}~	

Set Default values | Set Best Practice values

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Table 6-4 User account management attributes

Attribute	Meaning
Identity Based User Accounts	When this is disabled, access to the web interface is controlled by a single system administration password. When this is enabled, the identity-based user account attributes are enabled. For more information, refer to Creating or updating identity-based users on page 6-42.
Auto Logout Period	The time without user activity that elapses before a user is automatically logged out (minutes).
Minimum Password Change Period	The minimum time that elapses before a user is allowed to change a password (minutes). A value of zero disables this feature.
Password Expiry Period	The time that elapses before a password expires (days). A value of zero disables this feature.
Maximum Number of Login Attempts	The maximum number of login attempts (with incorrect password) that are allowed before a user is locked out. Also, the maximum number of password change attempts before a user is locked out.
Login Attempt Lockout Action	Action to be taken when a user is locked out. 'Timeout' means the user is allowed to attempt to log in again after a specified period. 'Disabled' means the user is disabled.
Login Attempt Lockout Period	The time that elapses before a locked out user is allowed to log in again (minutes). Only displayed when Login Attempt Lockout Action is set to 'Timeout'.
Webpage Session Control	When this is enabled, any attempt to open a new tab or browser instance will force the user to re-enter password.
Password Expiry Action	The action to be taken by the PTP 600 when a password expires.

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Configuring password complexity

Complete this task to configure password complexity rules for the web-based management interface.

NOTE

If the unit is required to operate in FIPS 140-2 secure mode, password complexity configuration must be set to 'Best Practise Values'.

If identity-based user accounts are enabled, this task may only be performed by a Security Officer.

To set these options, proceed as follows:

Procedure 6-21 Configure password complexity

1	Select menu option **Management, Web, Local User Accounts**. The User Accounts page is displayed (Figure 6-26).
2	Review and update the password complexity configuration attributes (Table 6-5).
3	To reset all attributes to the best practice values (as shown in Table 6-5), select **Set Best Practice values**. This is required for FIPS 140-2.
4	If any attributes have been updated, select **Submit User Account Updates**.

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Table 6-5 Password complexity configuration attributes

Attribute	Meaning	Best practice value
Minimum Password Length	The minimum number of characters required in passwords.	10
Password Can Contain User Name	'No' means that passwords must not contain the user name. 'Yes' means that passwords may contain the user name.	No
Minimum Number Of Specific Characters	The minimum number of lowercase, uppercase, numeric and special characters required in passwords. For example, if all values are set to 2, then 'FredBloggs' will be rejected, but 'FredBloggs(25)' will be accepted.	2
Maximum Consecutive Repeated Characters	The maximum number of consecutive repeated alphabetic, numeric and special characters permitted in passwords. For example, if all values are set to 2, then 'aaa', 'XXX', '999' and '$$$' will be rejected, but 'aa', 'XX', '99' or '$$' will be accepted.	2
Maximum Consecutive Characters of a Certain Type	The maximum number of consecutive lowercase, uppercase and numeric characters permitted in passwords. For example, if all values are set to 5, then 'ALFRED', 'neuman' and '834030' will be rejected.	5
Maximum Series Length	The maximum number of alphabetic and numeric characters permitted in passwords. For example, if set to 3, then 'abcd', 'WXYZ' and '0123' will be rejected, but 'abc', 'xyz' and '123' will be accepted.	3

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Attribute	Meaning	Best practice value
Maximum Repeated Pattern Length	The maximum sequence of characters that can be repeated consecutively in passwords. For example, if set to 3, then ‘BlahBlah’ and ‘31st31st’ will be rejected, but ‘TicTicTock’ and ‘GeeGee’ will be accepted. ‘Blah-Blah’ will be accepted because the two sequences are not consecutive.	3
Match Reversed Patterns	‘No’ means that reversed patterns are not checked. ‘Yes’ means that reversed patterns are checked. For example, if Maximum Repeated Pattern Length is set to 3 and Match Reversed Patterns is set to ‘Yes’, then ‘AB1221BA’ will be rejected.	Yes
Minimum Characters That Must Change	The minimum number of password characters that must change every time a password is updated.	4
Password Reuse	‘Permitted’ means that a user may reuse a previous password. ‘Prohibited’ means that a user must not reuse a previous password.	Prohibited
Special Characters	User defined set of special characters used in password construction. The only characters permitted in a password are: (a-z), (A-Z), (0-9) and any of the special characters entered here.	!"%&'()*+,-./:;<=>?

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Task 6: Set passwords

This task consists of the following procedures:

- Creating or updating identity-based users on page 6-42
- Changing own user password on page 6-44
- Protecting access to the summary and status pages on page 6-45

Creating or updating identity-based users

Perform this task to allow multiple users (from one to ten) to access the ODU with different levels of access. There are three defined levels of access: Security Officer, System Administrator and Read Only.

NOTE

If the unit is required to operate in FIPS 140-2 secure mode, at least three identity-based used accounts must be created, and the Secuirty Officer password must be compliant with network security policy.

If identity-based user accounts are already enabled, this task may only be performed by a user with role set to Security Officer.

To create or update identity-based user accounts, proceed as follows:

Procedure 6-22 Configure user accounts

1	Select menu option **Management, Web, Local User Accounts**. The User Accounts page is displayed (Figure 6-26).
2	Set the Identity Based User Accounts attribute to 'Enabled' (if it is not already set). The identity-based user account attributes are enabled for update (Figure 6-27).
3	Create or update up to 10 user accounts (Table 6-6).
4	If any accounts have been created or updated, select **Submit User Account Updates**.

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Figure 6-27 Identity-based user accounts

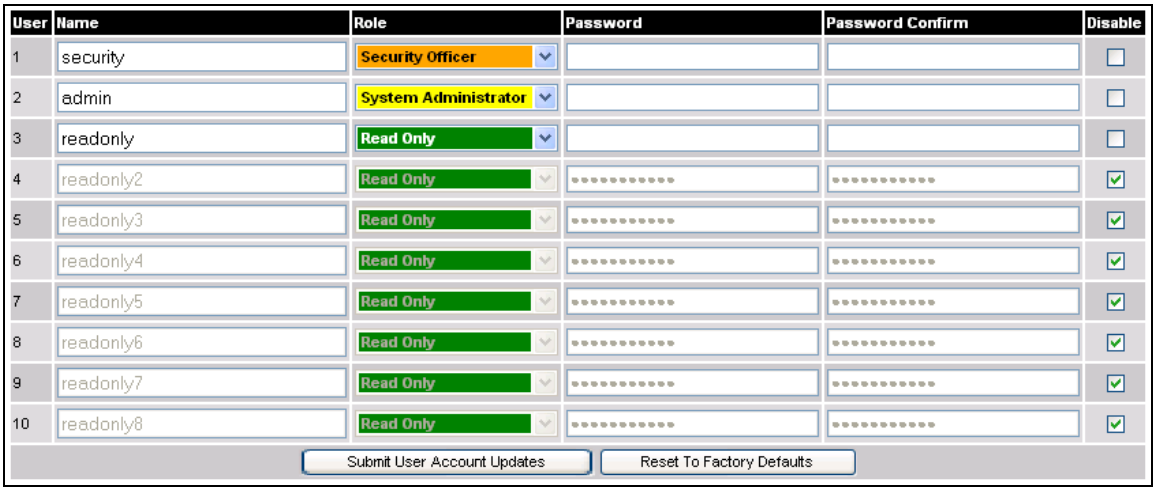


Table 6-6 Identity-based user accounts attributes

Attribute	Meaning
Name	Enter a user name.
Role	Select a role from the list: Security Officer System Administrator Read Only **NOTE** At least one user must be assigned the Security Officer role. If RADIUS is enabled, then this rule is relaxed, in which case the RADIUS server(s) SHOULD be configured with at least one user with 'Security Officer' privileges.
Password	Enter a password for the user. Passwords must comply with the complexity rules (Table 6-5).
Password Confirm	Retype the password to confirm.
Disable	Tick the box to disable a user account.

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Changing own user password

This method is used for any user to change his/her own password.

NOTE

A security officer can change the passwords of other users using the User Accounts page, as described in Creating or updating identity-based users on page 6-42.

Select menu option **Change Password**. The Change Password page is displayed (Figure 6-28). Enter and confirm the new password (the factory default is blank). The new password must comply with the complexity rules (Table 6-5).

Figure 6-28 Change Password page (System Administration example)



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Protecting access to the summary and status pages

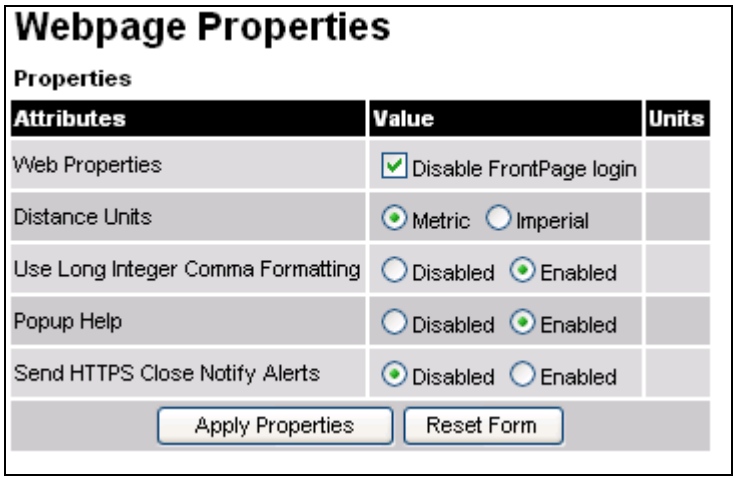
By default, the Home and Status menu items are not protected by password. If a higher level of system security is required, password protection can be extended to these pages.

To apply password access to the System Summary and System Status pages, proceed as follows:

Procedure 6-23 Enable front page logintion

1	Select menu option **Management, Web, Web Properties**. The Webpage Properties page is displayed (Figure 6-29).
2	In the Web Properties attribute, uncheck the 'Disable FrontPage login' box.
3	Select **Apply Properties**.
4	If the System Administration Password has not yet been set, see Changing own user password on page 6-44.

Figure 6-29 Webpage Properties page



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Task 7: Configure wireless interface

This task consists of the following procedures:

- Updating the system configuration on page 6-46
- Updating quality of service on page 6-48
- Updating wireless configuration on page 6-50
- Configuring telecoms circuits on page 6-68

Updating the system configuration

To update the system configuration of the PTP 600 to meet network requirements, proceed as follows:

Procedure 6-24 Update IP and Ethernet configuration for network

1	Select menu option **System, Configuration**. The System configuration page is displayed (Figure 6-16).
2	Update the following attributes as required (Table 6-7): Link Name (only if Link Name Access is disabled) Site Name Max Receive Modulation Mode Ethernet Capped Max Wireless Speed
3	Select **Submit Updated System Configuration**.

Table 6-7 System Configuration attributes

Attribute	Meaning
Link Name	User defined identity for the unit. If Link Name Access is enabled, this is updated in Step 2: Wireless configuration on page 6-54.
Site Name	User defined name for the site, with additional notes (if required).
Master Slave Mode	Read only. Updated in Step 2: Wireless configuration on page 6-54.
Link Mode Optimization	Read only. Updated in Step 2: Wireless configuration on page 6-54.

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Attribute	Meaning
Channel Bandwidth	Read only. Updated in Step 2: Wireless configuration on page 6-54.
Max Receive Modulation Mode	This is the maximum mode the unit will use as its adaptive modulation. By default the Max Receive Modulation Mode is the highest mode available. For minimum error rates, set the maximum modulation mode to the minimum necessary to carry the required traffic.
Ethernet Capped Max Wireless Speed	When enabled, this option will cap the wireless speed to a mode that the connected Ethernet connection can sustain.
Maximum Transmit Power	Updated in Step 2: Wireless configuration on page 6-54.
Antenna Gain	This is only displayed when Platform Variant is set to 'Connectorized' in Step 2 of the Installation wizard. Updated in Step 2: Wireless configuration on page 6-54.
Cable Loss	This is only displayed when Platform Variant is set to 'Connectorized' in Step 2 of the Installation wizard. Updated in Step 2: Wireless configuration on page 6-54.
EIRP	This is only displayed when Platform Variant is set to 'Connectorized' in Step 2 of the Installation wizard. Effective Isotropic Radiated Power (EIRP) describes the strength of the radio signal leaving the wireless unit. Use it to verify that the link configuration (Max Transmit Power, Antenna Gain and Cable Loss) does not exceed any applicable regulatory limit.
Encryption Algorithm	This is only displayed when AES encryption is enabled by licensed key. Updated in Task 4: Configure security on page 6-21.
Encryption Key	This is only displayed when AES encryption is enabled by licensed key. Updated in Task 4: Configure security on page 6-21.
Confirm Encryption Key	This is only displayed when AES encryption is enabled by licensed key. Updated in Task 4: Configure security on page 6-21.

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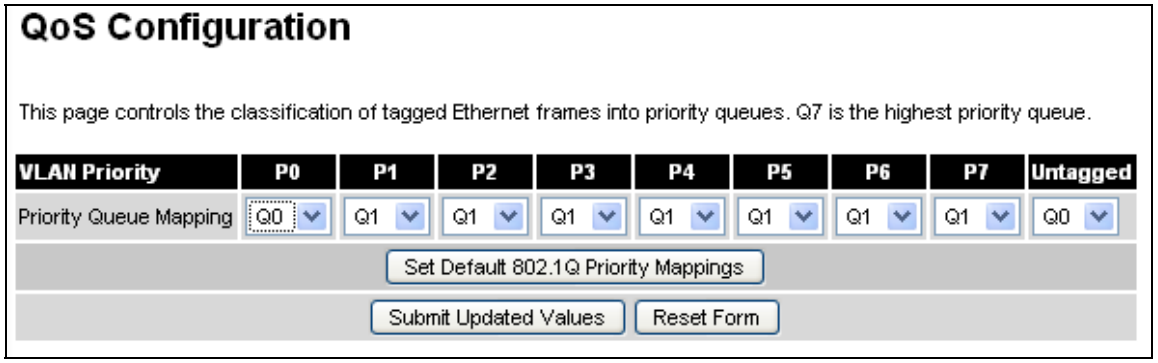
Updating quality of service

To configure the classification of priority encoded Ethernet frames into up to eight traffic classes, proceed as follows:

Procedure 6-25 Update IP and Ethernet configuration for network

1	Select menu option **System, Configuration, QoS Configuration**. The QoS Configuration page is displayed (Figure 6-30).
2	Update the Priority Queue Mapping as required. The higher the queue number the greater its priority. The default rules are shown in Table 6-8.
3	To use IEEE 802.1Q classification rules, select **Set Default 802.1Q Priority Mappings**. The 802.1Q rules are shown in Table 6-8.
4	Select **Submit Updated Values**.

Figure 6-30 QoS Configuration page



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Table 6-8 QoS default settings

VLAN Priority	QoS default traffic class	IEEE802.1Q traffic class
P0	Q0	Q1
P1	Q1	Q0
P2	Q1	Q2
P3	Q1	Q3
P4	Q1	Q4
P5	Q1	Q5
P6	Q1	Q6
P7	Q1	Q7
Untagged	Q0	Q1

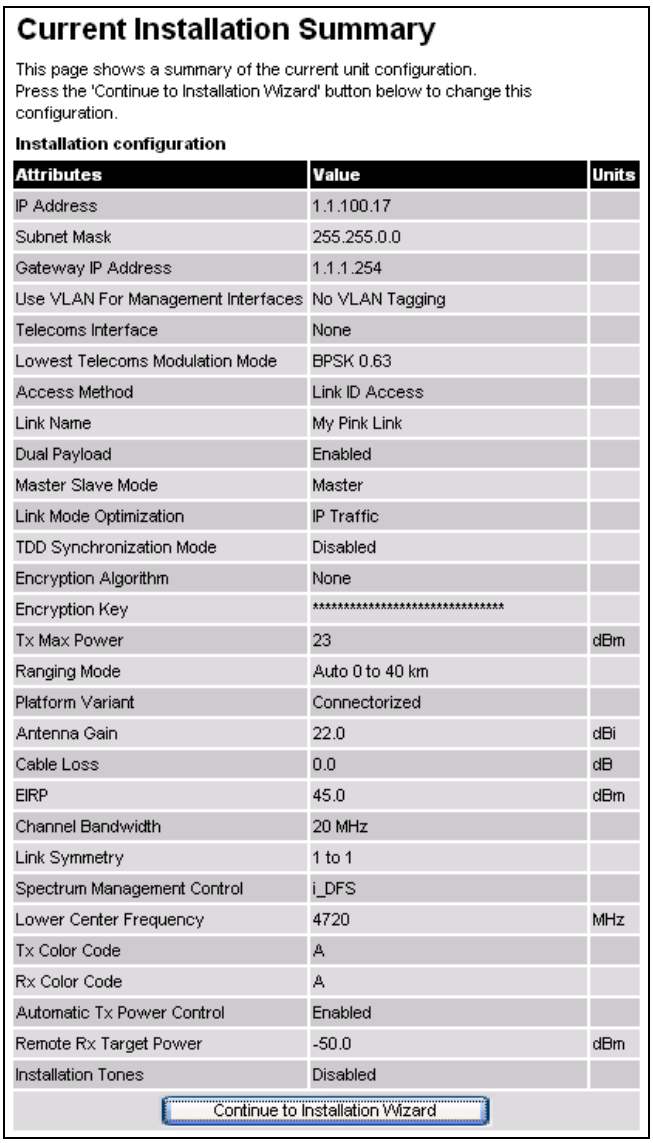
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Updating wireless configuration

Starting installation wizard

To check that the factory wireless configuration meets network requirements, select menu option **Installation**. The Current Installation Summary page (Figure 6-31) is displayed. Review the attributes. If they do not meet requirements, select **Continue to Installation Wizard**.

Figure 6-31 Current installation summary page



Current Installation Summary

This page shows a summary of the current unit configuration.
Press the 'Continue to Installation Wizard' button below to change this configuration.

Installation configuration

Attributes	Value	Units
IP Address	1.1.100.17	
Subnet Mask	255.255.0.0	
Gateway IP Address	1.1.1.254	
Use VLAN For Management Interfaces	No VLAN Tagging	
Telecoms Interface	None	
Lowest Telecoms Modulation Mode	BPSK 0.63	
Access Method	Link ID Access	
Link Name	My Pink Link	
Dual Payload	Enabled	
Master Slave Mode	Master	
Link Mode Optimization	IP Traffic	
TDD Synchronization Mode	Disabled	
Encryption Algorithm	None	
Encryption Key	**********	
Tx Max Power	23	dBm
Ranging Mode	Auto 0 to 40 km	
Platform Variant	Connectorized	
Antenna Gain	22.0	dBi
Cable Loss	0.0	dB
EIRP	45.0	dBm
Channel Bandwidth	20 MHz	
Link Symmetry	1 to 1	
Spectrum Management Control	i_DFS	
Lower Center Frequency	4720	MHz
Tx Color Code	A	
Rx Color Code	A	
Automatic Tx Power Control	Enabled	
Remote Rx Target Power	-50.0	dBm
Installation Tones	Disabled	

Continue to Installation Wizard

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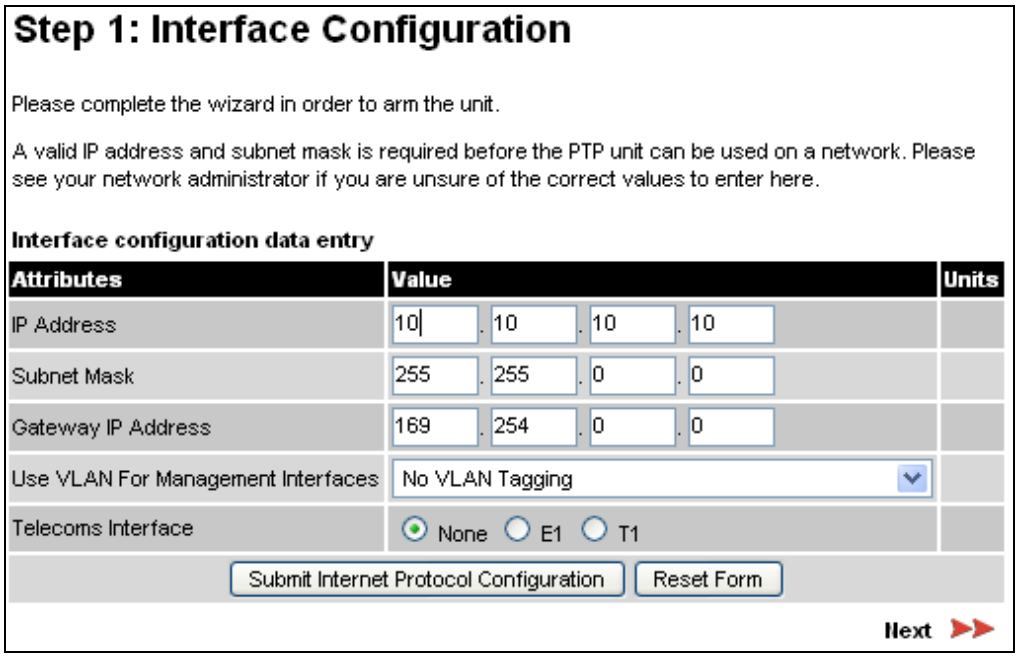
Step 1: Interface configuration

Step 1 of the Installation wizard is for updating the interface configuration (Figure 6-32 or Figure 6-33). The attributes are described in Table 6-9. Update the attributes as required and select **Next**.

NOTE

If a copper loopback is used to test the E1 or T1 link (if enabled), ensure that the test set is configured manually. If the test set is allowed to configure automatically, neither it nor the ODU send a signal until they receive one, so the test appears to fail.

Figure 6-32 Step 1: Interface Configuration page



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Figure 6-33 Step 1: Interface Configuration page with T1 enabled

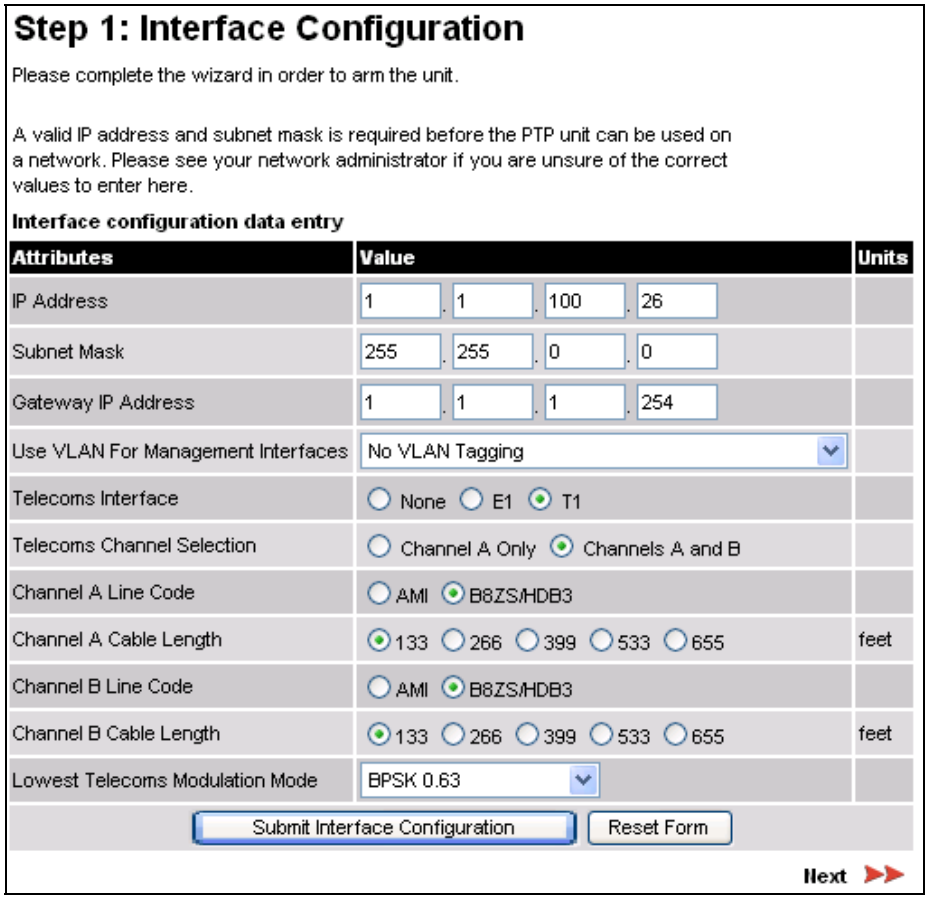


Table 6-9 Step 1: Interface Configuration standard attributes

Attribute	Meaning
IP Address	Updated in Updating the IP and Ethernet configuration on page 6-6.
Subnet Mask	Updated in Updating the IP and Ethernet configuration on page 6-6.
Gateway IP Address	Updated in Updating the IP and Ethernet configuration on page 6-6.
Use VLAN For Management Interfaces	Updated in Updating the IP and Ethernet configuration on page 6-6.

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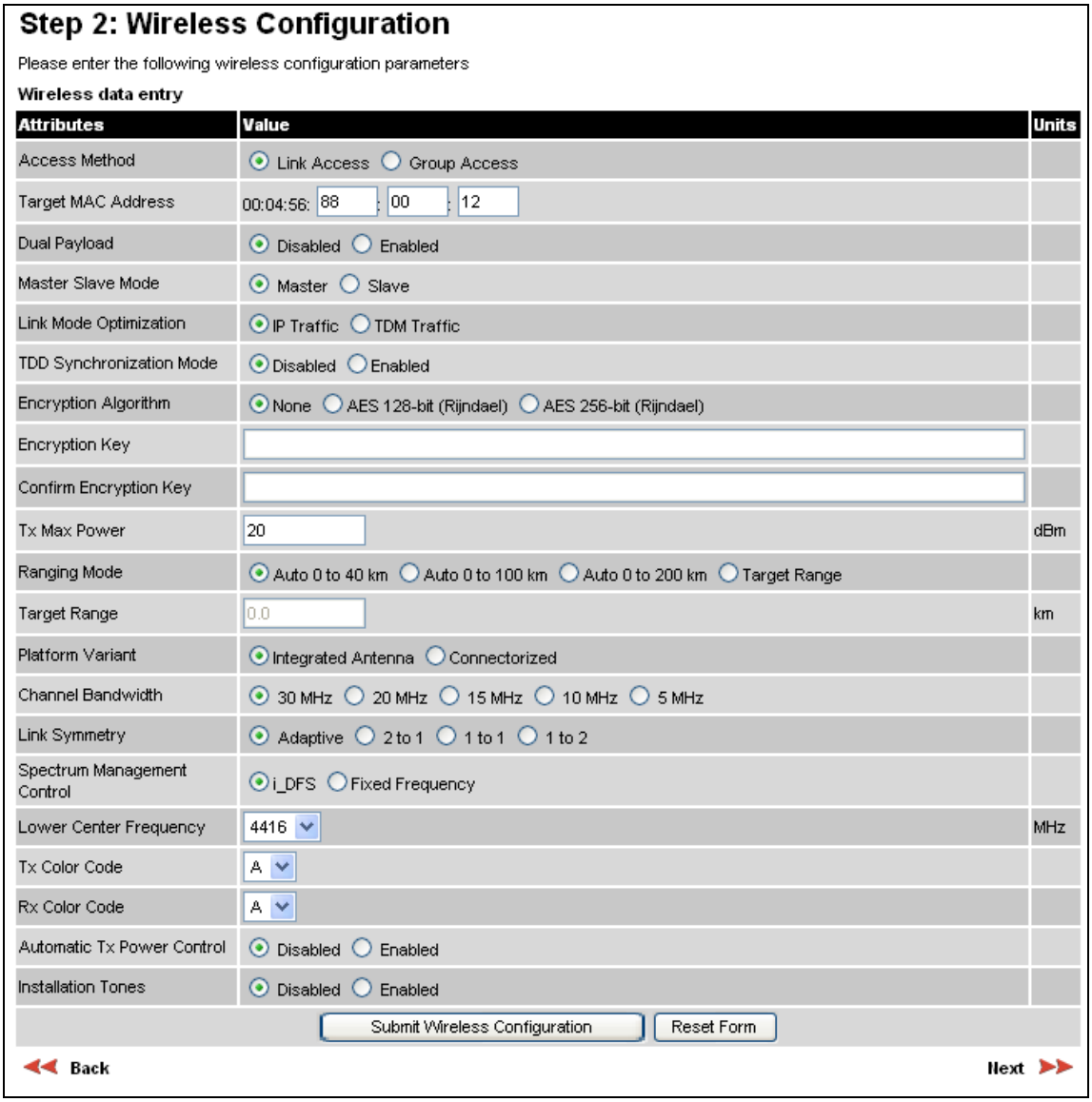
Attribute	Meaning
VLAN Management VID	Only displayed when Use VLAN for Management Interfaces is enabled. Updated in Updating the IP and Ethernet configuration on page 6-6.
VLAN Management Priority	Only displayed when Use VLAN for Management Interfaces is enabled. Updated in Updating the IP and Ethernet configuration on page 6-6.
Management Mode	Only displayed when Use VLAN for Management Interfaces is enabled. Updated in Updating the IP and Ethernet configuration on page 6-6.
Telecoms Interface	This allows the activation of the telecoms interface. The selection options are None, E1 or T1.
Telecoms Channel Selection	Only displayed when Telecoms Interface is set to 'E1' or 'T1' (Figure 6-33). The PTP 600 can support one or two telecoms channels ('Channel A only' or 'Channels A and B').
Channel A Line Code	Only displayed when 'E1' or 'T1' are selected (Figure 6-33). Must match the setting of the device connected to channel A.
Channel A Cable Length	Only displayed when 'T1' is selected (Figure 6-33). The length of the cable connecting the ODU to the channel A transceiver.
Channel B Line Code	Only displayed when 'E1' or 'T1' are selected with 'Channels A and B' (Figure 6-33). Must match the setting of the device connected to channel B.
Channel B Cable Length	Only displayed when 'T1' is selected with 'Channels A and B' (Figure 6-33). The length of the cable connecting the ODU to the channel B transceiver.
Lowest Telecoms Modulation Mode	The lowest modulation mode at which telecoms data can be sent. If the link cannot sustain telecoms data in this mode then the effective lowest modulation mode may differ. In conjunction with the Link Planner tool, this setting may be used to optimize the latency for links which operate in consistently high modulation modes. High data rate links are able to support lower latencies. The effective lowest modulation mode is displayed on the Telecoms page.

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Step 2: Wireless configuration

Step 2 of the Installation wizard is for updating the wireless configuration (Figure 6-34 or Figure 6-35). The attributes are described in Table 6-10. Update the attributes as required and select **Next**.

Figure 6-34 Step 2: Wireless Configuration page



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Figure 6-35 Step 2: Wireless Configuration page for connectorized ODUs



Step 2: Wireless Configuration

Please enter the following wireless configuration parameters

Wireless data entry

Attributes	Value	Units
Target MAC Address	00:04:56: 80 : 27 : cb	
Master Slave Mode	(•) Master ( ) Slave	
Link Mode Optimization	(•) IP Traffic ( ) TDM Traffic	
TDD Synchronization Mode	(•) Disabled ( ) Enabled	
Tx Max Power	25	dBm
Ranging Mode	(•) Auto 0 to 40 km ( ) Auto 0 to 100 km ( ) Auto 0 to 200 km ( ) Target Range	
Target Range	0.0	km
Platform Variant	( ) Integrated Antenna (•) Connectorized	
Antenna Gain	23.0	dBi
Cable Loss	0.0	dB
Channel Bandwidth	( ) 30 MHz (•) 15 MHz ( ) 10 MHz ( ) 5 MHz	
Link Symmetry	( ) Adaptive ( ) 2 to 1 (•) 1 to 1 ( ) 1 to 2	
Spectrum Management Control	( ) i_DFS (•) Fixed Frequency	
Default Raster	(•) On ( ) Off	
Fixed Tx Frequency	5736	MHz
Tx Color Code	B	
Fixed Rx Frequency	5736	MHz
Rx Color Code	A	
Installation Tones	(•) Disabled ( ) Enabled	

Submit Wireless Configuration | Reset Form

◀◀ Back Next ▶▶

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The contents of the Wireless Configuration page vary depending upon the frequency variant as follows:

- PTP 25600: Frequency Band field is also displayed.
- Channel Bandwidth options vary depending upon frequency variant and region. For more information, see Table 1-1.
- PTP 49600: Lower Center Frequency is not displayed.

Page contents also vary depending upon the options selected as follows:

- If Spectrum Management Control is set to ‘Fixed Frequency’, the Lower Center Frequency field is replaced by Fixed Tx Frequency and Fixed Rx Frequency.
- If Platform Variant is set to ‘Connectorized’, Antenna Gain and Cable Loss are also displayed.

Table 6-10 Step 2: Wireless Configuration attributes

Attribute	Meaning
Access Method	‘Link Access’ means that the link is established between a pre-paired Master and Slave. ‘Link Name Access’ means that a link can only be established between units that have identical Link Name attributes. ‘Group Access’ means that a link can only be established between units that have identical Group ID attributes.
Link Name	Only displayed when Access Method is set to ‘Link Name Access’. A link can only be established between units that have identical Link Names. Link Name may consist of letters (A-Z and a-z), numbers (0-9), spaces, and the following special characters: (),-.,:<=>[]_{}
Group ID	Only displayed when Access Method is set to ‘Group Access’. A link can only be established between units that have identical Group IDs.

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Attribute	Meaning
Target MAC Address	This is only displayed when Access Method is set to 'Link Access'. This is the MAC Address of the peer unit that will be at the other end of the wireless link. This is used by the system to ensure the unit establishes a wireless link to the correct peer. The MAC Address can be found embedded within the serial number of the unit. The last six characters of the serial number are the last three bytes of the unit's MAC address. **NOTE** A PTP 600 Series system is shipped as a pair of units with pre-loaded correct MAC addresses. Target MAC addresses will only need to be entered if an existing unit has to be replaced in the field or the units configuration has been erased.
Dual Payload	This controls whether the link takes advantage of the channel condition to increase the link throughput. If set to 'Disable', the robustness of the link is improved. The default value is 'Enabled'. This control is automatically set to 'Enabled' if either E1 or T1 is enabled and Lowest Telecoms Modulation Mode is set to a Dual Payload modulation.
Master Slave Mode	At this point it is necessary to decide which end will designate a Master. The Master unit is the controlling unit with respect to the point-to-point link and its maintenance. The master transmits until the link is made, while the Slave listens for its peer and only transmits when the peer has been identified.
Link Mode Optimization	Optimizes the link behavior according to the type of traffic that will be bridged. There are two modes to choose from: IP and TDM. For more information, see Link mode optimization on page 1-25.
TDD Synchronization Mode	Enables the TDD synchronization feature. See TDD synchronization on page 1-33 for basic description and Step 3: TDD synchronization (optional) on page 6-64 for installation and configuration details.

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Attribute	Meaning
Encryption Algorithm	This is only displayed when encryption is enabled by license key. The same algorithm must be used at both ends of the link. Updated in Task 4: Configure security on page 6-21.
Encryption Key	This is only displayed when encryption is enabled by license key. The same key must be used at both ends of the link. When identity based user accounts are enabled, only the Security Officer can change the encryption key. Updated in Task 4: Configure security on page 6-21.
Confirm Encryption Key	This is only displayed when encryption is enabled by license key. Must contain the same value as Encryption Key.
Tx Max Power	This attribute controls the maximum transmit power (dBm) the unit is permitted to use when installing and operating the wireless link. The maximum setting for a particular region or country is controlled by the License Key. It can be changed in 1dB steps. **Why Reduce Transmit Power?** If the link losses are low and the link data rate and availability targets are being easily achieved, the transmitted power level may be reduced with a consequent benefit to other users of the band, such as fixed satellite links.
Ranging Mode	During installation, the wireless units perform “Automatic Ranging”. The ranging mode allows the installer to control the behavior of the system’s automatic ranging algorithms. The default value is 0 to 40 km (0 to 25 miles). If the installer is required to install a link of greater than 40 km (25 miles) then the ranging mode attribute MUST be configured to ‘0 to 100km’ (0 to 62 miles) or ‘0 to 200km’ (0 to 124 miles) mode depending on the range of the link. **NOTE** If preferred, range functions can be configured to operate in miles, as described in Protecting access to the summary and status pages on page 6-45.

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Attribute	Meaning
Target Range	Installers that know the range between the two wireless units to within ± 1 km can use the target range mode. The main advantage of the target range mode is that it reduces the time taken by the units to range. To use the target range mode the installer MUST select Target Range as the ranging mode and enter the approximate range in km in the Target range data entry field at both ends of the link.
Platform Variant	Chooses between an integrated unit or a connectorized unit that requires an external antenna.
Antenna Gain	Gain of the antenna that is connected to the unit.
Cable Loss	Loss in the cable between the ODU and the antenna. **NOTE** If there is a significant difference in length of the antenna cables for the two antenna ports, then the average value should be entered.
Frequency Band	Only displayed for the PTP 25600 frequency variant, which operates in one of three bands as described in Variable channel bandwidth operation on page 2-5: Lower: 2496 MHz to 2568 MHz Middle: 2572 MHz to 2614 MHz Upper: 2624 MHz to 2690 MHz
Channel Bandwidth	Users can choose a variable channel bandwidth for the available spectrum. The selection depends upon the frequency variant and region. For more information, see Table 1-1.

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Attribute	Meaning
Link Symmetry	(Master only) Values of "Adaptive", "2 to 1", "1 to 1" and "1 to 2" can be selected. The adaptive setting allows link symmetry to vary dynamically in response to offered traffic load. The remaining values select three options for fixed division between transmit and receive time in the TDD frame of the master ODU. The first number in the ratio represents the time allowed for the transmit direction and the second number represents the time allowed for the receive direction. The appropriate matching Link Symmetry is set at the slave ODU automatically. For example, if Link Symmetry is configured as '2 to 1' at the master ODU, then the slave ODU will be set automatically as '1 to 2'. In this example, the master-slave direction has double the capacity of the slave-master direction. Link Symmetry is subject to the following restrictions: 'Adaptive' is not supported in regions where radar avoidance is in use. 'Adaptive' is not supported when link optimization is set to 'TDM'. 'Adaptive' is not supported in 5 MHz channel bandwidth. '2 to 1' and '1 to 2' are not supported in 5 MHz channel bandwidth. '2 to 1' and '1 to 2' are not supported when E1/T1 services are enabled.
Spectrum Management Control	Is used to configure the PTP 600 Series Spectrum Management features, see Managing spectrum on page 7-22 for more details. In regions that do not mandate DFS (Radar Detection), the Spectrum Management Control options are 'i-DFS' and 'Fixed Frequency'. In regions that mandate DFS (Radar Detection), the Spectrum Management Control options are 'DFS' and 'DFS with i-DFS'. The Spectrum Management Control is disabled if the regulatory requirement is fixed frequency only (for example if the frequency variant is PTP 25600).

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Attribute	Meaning
Lower Center Frequency	Not displayed for the PTP 49600. Not displayed when Spectrum Management Control is set to 'Fixed Frequency'. The software for the PTP 600 Series allows a user to optionally adjust the channel center frequencies. Changing the Lower Center Frequency attribute causes all channel center frequencies to be offset. It effectively slides the channelization up or down. **NOTE** Because the 4.9 GHz spectrum is restricted by license, the Lower Center Frequency is fixed for the PTP 49600 and is therefore not displayed. **CAUTION** The lower center frequency attribute must be configured to the same value for both the master and slave. Failure to do so will cause the wireless link to fail reestablishment. The only way to recover from this situation is to modify the Lower Center Frequency attribute so that they are identical on both the master and slave unit.
Default Raster	This is only displayed when Spectrum Management Control is set to 'Fixed Frequency'. If this is set to 'On', the list of options presented in the fixed Tx frequency box is limited by the default raster.

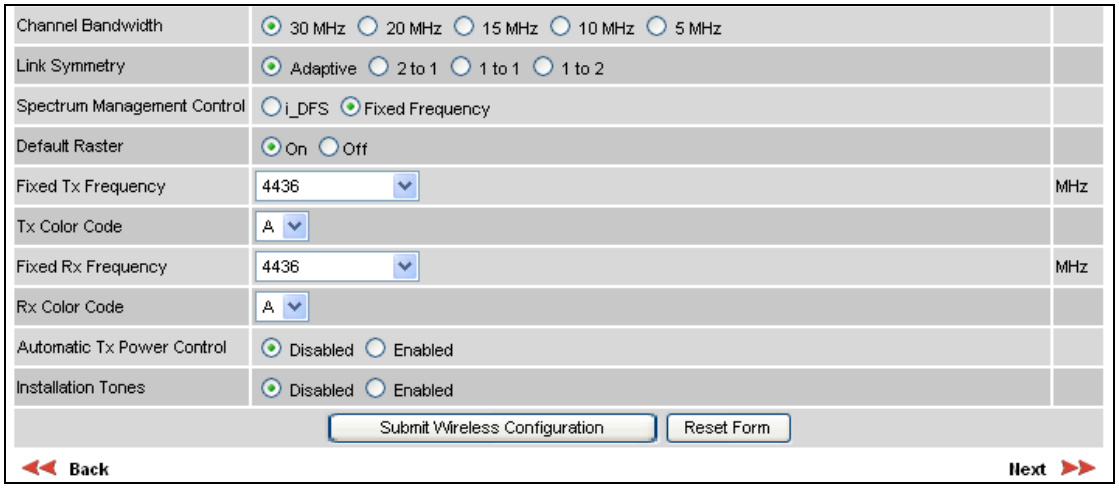
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Attribute	Meaning
Fixed Tx Frequency, Fixed Rx Frequency	This is only displayed when Spectrum Management Control is set to 'Fixed Frequency'. The software for the PTP 600 Series allows a user to optionally fix the Transmit and the Receive frequencies for a wireless link. The settings must be compatible at each end of the link. Once configured, the spectrum management software will not attempt to move the wireless link to a channel with lower co-channel or adjacent channel interference. Therefore this mode of operation is only recommended for deployments where the installer has a good understanding of the prevailing interference environment. Figure 6-36 shows an example of the fixed frequency configuration for a 30 MHz channel bandwidth. In this example, the Fixed Transmit Frequency is set to 4436 MHz and the Fixed Receive Frequency is set to 4436 MHz. Care must be taken when configuring the Fixed Transmit and Receive Frequencies to ensure that both frequencies are on the same channel raster as the Lower Center Frequency. For example, if the channel raster is 10 MHz, both the Fixed Transmit and Receive Frequencies must be a multiple of 10 MHz from the Lower Center Frequency (4426 = 4416 + 10 MHz) and (4486 = 4416 + 10 MHz × 7). **NOTE** A raster limits the selection of the Rx frequency based upon the setting of the Tx frequency.
Tx Color Code, Rx Color Code	The Tx Color Code and Rx Color Code attributes need only be considered when the unit is installed in a dense network of synchronized PTP 600 units and where some of the PTP 600 units are operating on the same frequency. In this case, the value would normally be derived by a network radio planner. In all other cases, it is strongly recommended that this attribute is left at the default value of 'A'. **NOTE** The value of Tx Color Code MUST always match the value of Rx Color Code at the other end of the link.

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Attribute	Meaning
Automatic Tx Power Control	Automatic Transmit Power Control (ATPC) availability is frequency variant dependent. When available, its default setting is 'Enabled'. If Master Slave Mode has been set to 'Slave', the additional option 'Enabled with ITPE' is available. When selected, the unit calculates its transmit power prior to enabling its transmitter in order to minimize the interference caused to other user in the band.
Installation Tones	'Disabled' means that audio tones will not be emitted during antenna alignment. 'Enabled' means that audio tones will be emitted during antenna alignment (the recommended option).

Figure 6-36 Step 2: Wireless Configuration page (extract) for fixed frequency



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Step 3: TDD synchronization (optional)

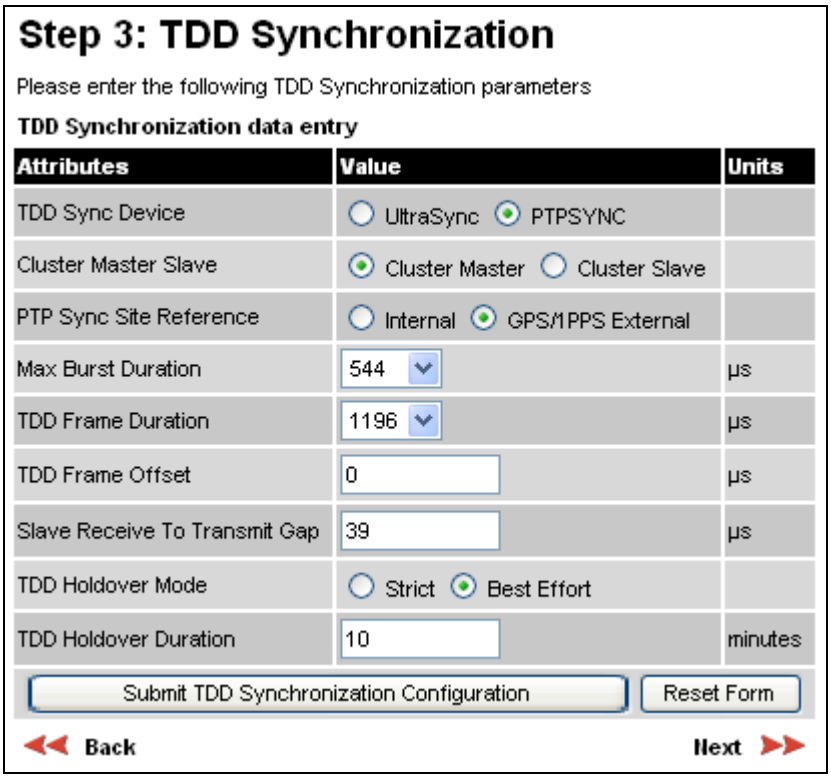
To enable TDD Synchronization, set the TDD Synchronization Mode attribute to 'Enabled' in the Step 2: Wireless Configuration page (Figure 6-34) and select **Next**. Step 3: TDD Synchronization page is displayed (Figure 6-37). The attributes are described in Table 6-11. Update the attributes as required and select **Next**.

For more information on the available options, refer to Configuration options for TDD synchronization on page 2-27.

When TDD Synchronization is enabled, the following restrictions apply:

- Ranging Mode and Target Range are disabled.
- Link Symmetry is forced to '1:1' operation only.

Figure 6-37 Step 3: TDD Synchronization page



NOTE

The data required to populate this screen is available in PTP Link Planner.

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Table 6-11 Step 3: TDD Synchronization attributes

Attribute	Meaning
TDD Sync Device	Select the timing device that is to be used for TDD synchronization.
Cluster Master Slave	Only displayed when TDD Sync Device is set to 'PTPSYNC'. 'Cluster Master' is the first ODU in the synchronization chain. 'Cluster Slave' is the second or subsequent ODU in the chain.
PTP-SYNC Site Reference	Only displayed when TDD Sync Device is set to 'PTPSYNC'. 'Internal' means standalone operation with no external timing reference. 'GPS/1PPS External' means that an external GPS receiver will provide a 1 pps timing reference.
Max Burst Duration	The maximum duration of the burst opportunity. Select a value in the range 726 to 2176 microseconds.
TDD Frame Duration	Select a value in the range 1730 to 6410 microseconds.
TDD Frame Offset	The delay of the start of the TDD frame from the epoch of the external timing reference. This permits the design of synchronized networks in which the phase of the TDD frame is independent of the master/slave function. Enter a value in the range from zero to one microsecond less than the TDD Frame Duration.
Slave Receive To Transmit Gap	The duration of the gap between receive and transmit at the slave ODU.
TDD Holdover Mode	(Master only). 'Strict' means that the unit will not transmit when synchronization is lost. 'Best Effort' means that the unit will synchronize when there is a reference signal, but otherwise will operate in unsynchronized mode.
TDD Holdover Duration	(Master only). Default value 10 minutes, maximum 60 minutes. Specifies duration of holdover period following loss of the external timing reference for TDD synchronization.

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Step 3 or 4: Confirm installation configuration

Step 3 of the Installation wizard is for confirming the wireless configuration parameters (Figure 6-38) (Step 4 if TDD Synchronization is enabled). The page contents vary depending upon the product variant and configuration options selected.

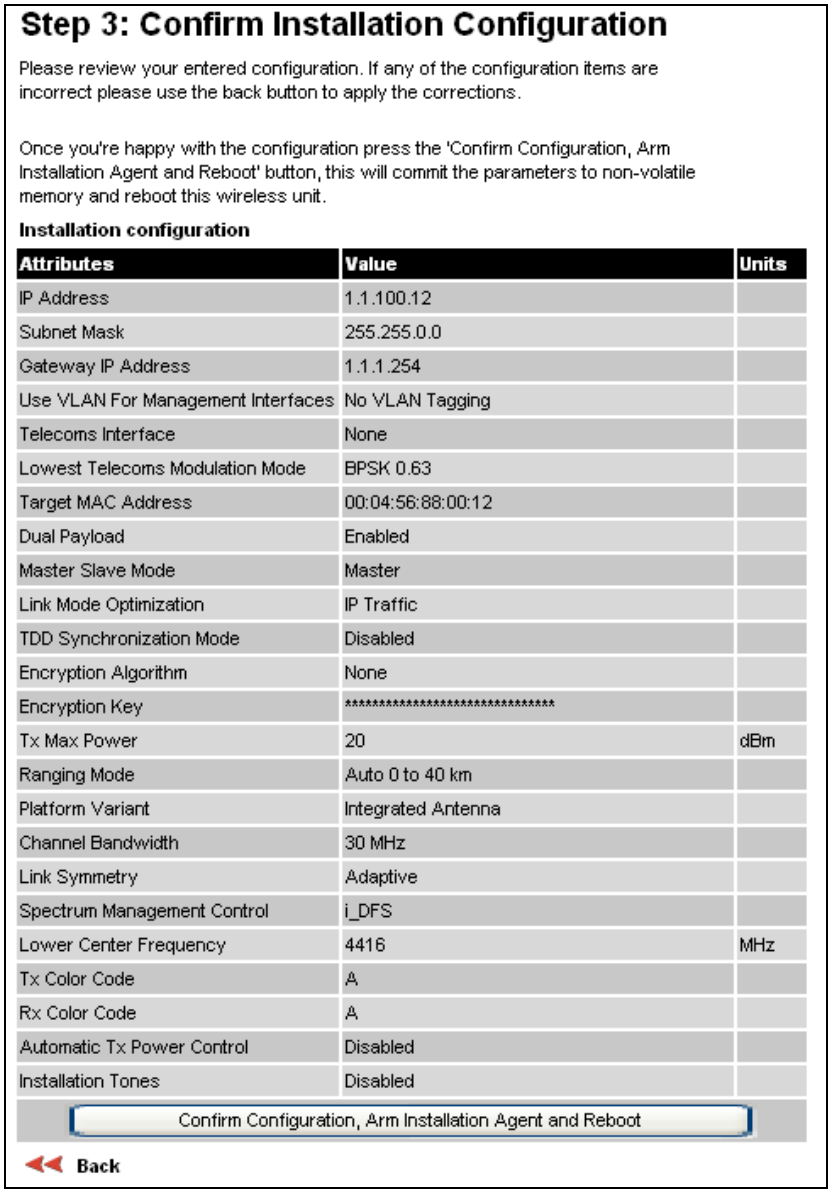
If any of the Installation wizard attributes have been updated, select **Confirm Configuration, Arm Installation and Reboot**. The confirmation popup is displayed (Figure 6-39). Select **OK** to reboot.

NOTE

If any of the interface attributes have been updated in Step 1 of the Installation wizard, the local management PC will not be able to communicate after the changes are confirmed and the reboot occurs. If it is necessary to make further configuration changes using the local management PC, modify the network configuration of the PC Ethernet port to match the new IP and VLAN configuration of the unit.

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Figure 6-38 Step 3: Confirm Installation Configuration page



Step 3: Confirm Installation Configuration

Please review your entered configuration. If any of the configuration items are incorrect please use the back button to apply the corrections.

Once you're happy with the configuration press the 'Confirm Configuration, Arm Installation Agent and Reboot' button, this will commit the parameters to non-volatile memory and reboot this wireless unit.

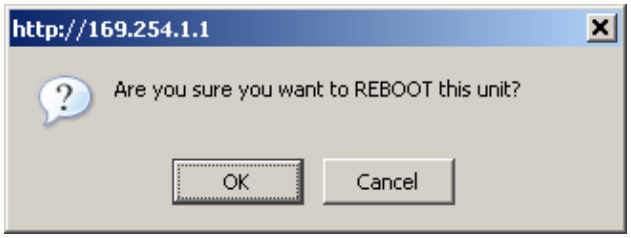
Installation configuration

Attributes	Value	Units
IP Address	1.1.100.12	
Subnet Mask	255.255.0.0	
Gateway IP Address	1.1.1.254	
Use VLAN For Management Interfaces	No VLAN Tagging	
Telecoms Interface	None	
Lowest Telecoms Modulation Mode	BPSK 0.63	
Target MAC Address	00:04:56:88:00:12	
Dual Payload	Enabled	
Master Slave Mode	Master	
Link Mode Optimization	IP Traffic	
TDD Synchronization Mode	Disabled	
Encryption Algorithm	None	
Encryption Key	**********	
Tx Max Power	20	dBm
Ranging Mode	Auto 0 to 40 km	
Platform Variant	Integrated Antenna	
Channel Bandwidth	30 MHz	
Link Symmetry	Adaptive	
Spectrum Management Control	i_DFS	
Lower Center Frequency	4416	MHz
Tx Color Code	A	
Rx Color Code	A	
Automatic Tx Power Control	Disabled	
Installation Tones	Disabled	

Confirm Configuration, Arm Installation Agent and Reboot

Back

Figure 6-39 Reboot confirmation pop up



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Configuring telecoms circuits

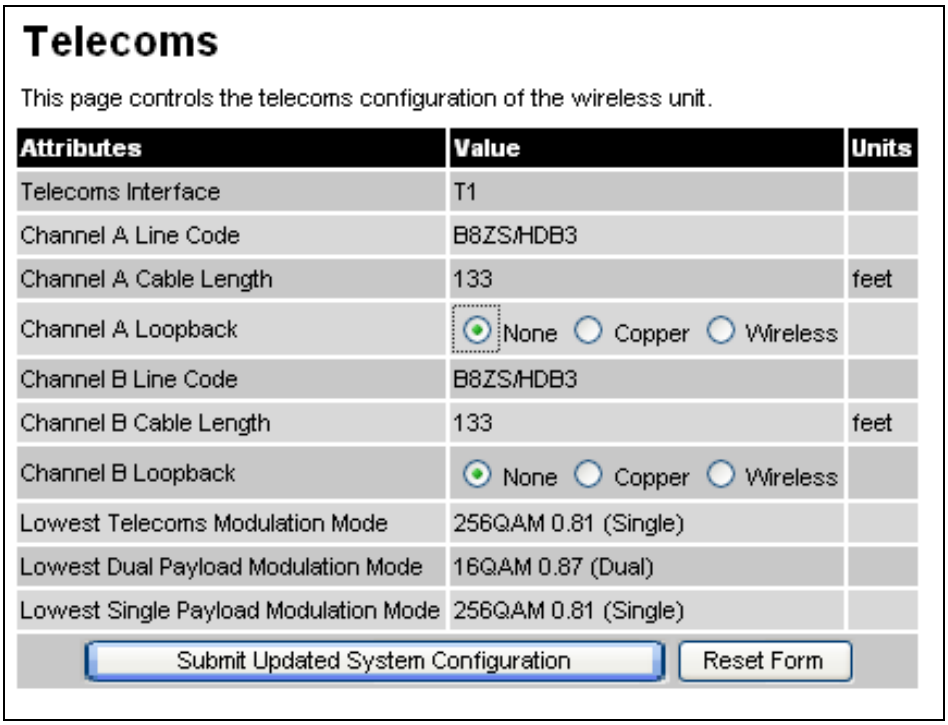
The Telecoms page is only available when the Telecoms Interface has been set to either T1 or E1 in the Installation Wizard.

To configure the telecoms circuits, proceed as follows:

Procedure 6-26 Configure telecoms circuits for network

1	Select menu option **System, Configuration, Telecoms**. The Telecoms page is displayed (Figure 6-40).
2	Review the attributes and update them if required (Table 6-12).
3	Select **Submit Updated System Configuration**.

Figure 6-40 Telecoms page



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Table 6-12 Telecoms attributes

Attribute	Meaning
Telecoms Interface	May be either 'T1' or 'E1'. Updated in Step 1: Interface configuration on page 6-51.
Channel A Line Code	The Line Code setting for channel A. Updated in Step 1: Interface configuration on page 6-51.
Channel A Cable Length	Only displayed when Telecoms Interface is 'T1'. Updated in Step 1: Interface configuration on page 6-51.
Channel A Loopback	Allows the channel A data stream to be looped back at the copper or wireless interface. During normal operation, set it to 'None'. During installation, it may be helpful to test the telecoms links by performing loopback connections. A 'Copper' loopback connects the received data on a given telecoms interface to the transmit interface. A 'Copper' loopback may be used, in conjunction with a Bit Error Rate Tester, to confirm that the correct connections have been made to the ODU. This mode cannot be used for resistance tests as it is only capable of looping back valid telecoms signals. A 'Wireless' loopback sends the telecoms data received across the wireless link back across the link on the same Telecom channel. The link may be checked using, for example, a Bit Error Rate Tester to ensure that no errors are detected. A typical T1 or E1 installation might include a 'Copper' loopback on the local unit followed by a 'Wireless' loopback on the remote unit. It is important to remove all loopbacks on channels for normal operation. Alarms on the Home Page indicate the presence of loopbacks on either channel.
Channel B Line Code	The Line Code setting for channel B (if used). Updated in Step 1: Interface configuration on page 6-51.
Channel B Cable Length	Only displayed when channel B is used and Telecoms Interface is 'T1'. Updated in Step 1: Interface configuration on page 6-51.

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Attribute	Meaning
Channel B Loopback	Only displayed when channel B is used. Allows the channel B data stream to be looped back at the copper or wireless interface. See Channel A Loopback.
Lowest Telecoms Modulation Mode	The lowest modulation mode at which telecoms data can be sent. Updated in Step 1: Interface configuration on page 6-51.
Lowest Modulation Mode	Indicates the effective lowest modulation mode at which telecoms data can be sent, subject to wireless capacity and latency limitations. Under some circumstances, this may differ from the Lowest Telecoms Modulation Mode.

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Task 8: Align antennas

This task consists of the following procedures:

- Starting up the units on page 6-71
- Using the graphical installation option on page 6-72
- Using the ODU installation tones on page 6-73
- Aligning the units on page 6-74
- Observing behavior during alignment on page 6-75
- Aligning connectorized antennas on page 6-76

Before performing this task, check that hardware installation is complete at both the Master and Slave sites, apart from the network connections.

Starting up the units

To connect one of the units to a management PC and start up both units, proceed as follows:

Procedure 6-27 Starting the units after site hardware installation

1	Select the unit from which this process is to be controlled; either Master or Slave. This is the 'local' unit.
2	Check that the management PC is connected to the local unit, powered up and logged on.
3	Start the local unit.
4	Start the remote unit.
5	Log into the local unit as described in Logging into the web interface on page 6-4.

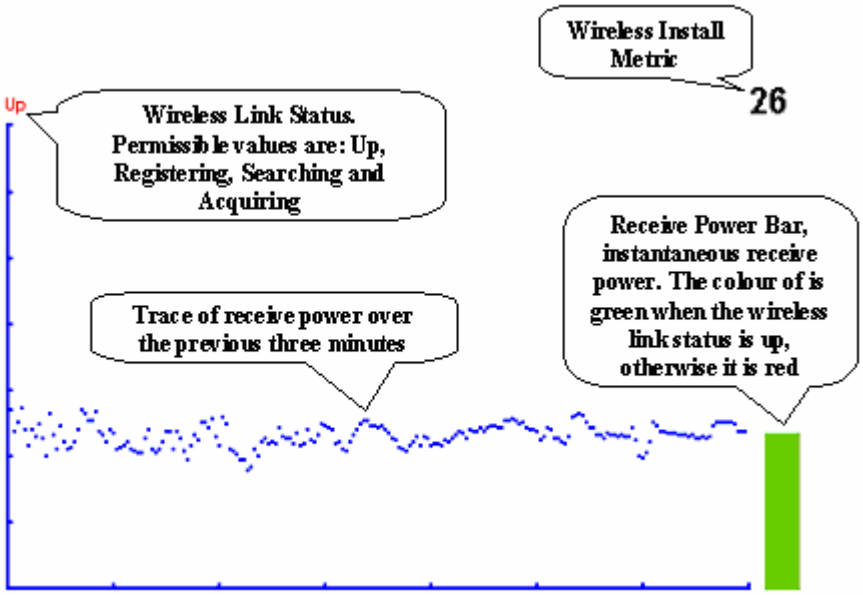
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Using the graphical installation option

Use the graphical installation option to aid the alignment process.

Select menu option **Installation, Graphical Install**. The Graphical Install page is displayed (Figure 6-41).

Figure 6-41 Graphical installation page



The screen displays the receive power over the last three minutes. This will allow the installer to slowly sweep the antenna during installation and monitor the variation in signal strength with angular position. The screen automatically refreshes every three seconds.

The screen also displays the current state of the wireless link in two ways. First, the actual state of the wireless link is written in the top left corner of the screen. The instantaneous receive power bar also encodes the state of the wireless link using green to signify that the wireless link is up and red for all other states.

For the more technically, aware the installation metric is simply the instantaneous receive power in dBm + 100.

PDA version

To access the PDA version of the graphical installation tool, use a hidden URL - **http://<ip-address>/pda.cgi**. This link is only available to system administrators.

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Using the ODU installation tones

The PTP 600 ODU emits audible tones during installation to assist with alignment. The pitch of the alignment tone is proportional to the received power of the wireless signals. Adjust the alignment of the unit in both azimuth and elevation until the highest pitch tone is achieved. The tones and their meanings are described in Table 6-13. In each of the states detailed in the table, align the unit to give the highest pitch tone.

Table 6-13 ODU installation tones

State Name	Tone Description	State Description	Pitch Indication
Free Channel Search	Regular beep	Executing band scan	N/A
Scanning	Slow broken tone	Not demodulating the wanted signal	Rx Power
Synchronized	Fast broken tone	Demodulating the wanted signal	Rx Power
Registered	Solid tone	Both Master and Slave units exchanging Radio layer MAC management messages	Rx Power
Alarm	Fast broken dual tone	A fatal error has occurred.	

The term ‘wanted signal’ refers to that of the peer unit being installed.

⚠ CAUTION

If, when in the Synchronized or Registered state, the tone varies wildly, there may be interference or a fast fading link. Installing in this situation may not give a reliable link. Investigate the cause of the problem.

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Aligning the units

For the ease of alignment, both Master and Slave units use the install tones in the same way but with some small behavioral differences. This allows the installer to install the Slave unit first and carry out the initial alignment with the Master unit if desired. However, due to the behavioral differences of Master and Slave units, it is recommended that the Master unit is installed first and the initial alignment carried out at the Slave unit.

To align the units, proceed as follows:

Procedure 6-28 Align Master and Slave

1	Adjust the elevation and azimuth of the Master unit to achieve an approximate visual alignment with the site of the Slave unit.
2	Adjust the elevation and azimuth of the Slave unit to achieve an approximate visual alignment with the site of the Master unit.
3	Without moving the Master unit, adjust the elevation and azimuth of the Slave unit to achieve the highest pitch installation tone.
4	Without moving the Slave unit, adjust the elevation and azimuth of the Master unit to achieve the highest pitch installation tone.
5	Repeat steps 3 and 4 as necessary to fine tune the alignment.

NOTE

To achieve best results, make small incremental changes to elevation and azimuth.

There is a graphical installation screen (see Using the graphical installation option on page 6-72) available in the web interface that displays the state of the link during the alignment process (up = green, down = red).

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Observing behavior during alignment

When the units are powered up and alignment begins, the following behavior may be observed:

Band scan

When first started up and from time to time, the Master unit will carry out a band scan to determine which channels are not in use. During this time, between 10 and 15 seconds, the Master unit will not transmit and as a consequence of this neither will the Slave unit. During this time the installation tone on the master unit will drop back to the band scan state, and the Slave unit will drop back to the Scanning state with the pitch of the tone set to the background noise level. Alignment of the unit should cease during this time.

Radar detection

If the unit is operating where mandatory radar avoidance algorithms are implemented, the ranging behavior for the PTP 600 Series may be affected. The Master has to monitor the initially chosen channel for 60 seconds to make sure it is clear of radar signals before transmitting. If a radar is detected during any of the installation phases, a further compulsory 60 seconds channel scan will take place as the master unit attempts to locate a new channel that is free of radar interference.

Ranging

The Master unit can take up to 60 seconds in 0-40 km (0-25 miles) mode, 90 seconds in 0-130 km (0-81 miles) mode and 120 seconds in 0-200 km (0-124 miles) mode to determine the range of the link being installed. The Master unit will remain in the Scanning state until the range of the link has been established. The Master unit will only move to the Synchronized state when the range of the link has been established.

The Slave unit does not have a ranging process. The slave unit will change to the Synchronized state as soon as the wanted signal is demodulated.

Retrying same channel

If, at the end of the ranging period, the Registered state is not achieved due to interference or other reasons, the Master unit will retry twice more on the same channel before moving to another available channel. Should this occur it might take a number of minutes to establish a link in the Registered state.

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Aligning connectorized antennas

When aligning antennas deployed with a connectorized ODU, it may not be possible to hear the alignment tone emanating from the unit. In this case it may be necessary for a second installer to assist in the operation. Alternatively, it may be possible to extend the tube on the supplied stethoscope to give a longer reach.

NOTE

Fine antenna alignment can sometimes be achieved by tightening and loosening the bolts on either side of the antenna mounting bracket, rather than trying to turn the whole bracket on the mounting pole.

CAUTION

Finally tightening the antenna mountings may cause the antenna alignment to be altered, due to distortion in the mounting bracket caused by action of tightening. It is recommended that the installation tone be left turned on (armed) during this process so that any movement can be noticed and counteracted by tightening the other side of the bracket.

Aligning dual polar antennas

The procedure for aligning dual polar antennas is the same as that for aligning integrated units, as described in Aligning the units on page 6-74.

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Aligning separate antennas

When using separate antennas at each site to achieve spatial diversity, one should be mounted with Horizontal polarization and the other with Vertical polarization.

To align separate antennas, proceed as follows:

Procedure 6-29 Aligning separate antennas

1	At the Master and Slave units, connect the Horizontal polarization antennas to the ODUs, but disconnect the Vertical polarization antennas.
2	Align the Horizontal polarization antennas using the installation tones, as described in Aligning the units on page 6-74.
3	At the Master and Slave units, connect the Vertical polarization antennas to the ODUs, but disconnect the Horizontal polarization antennas.
4	Align the Vertical polarization antennas using the installation tones, as described in Aligning the units on page 6-74.
5	Re-connect the Horizontal polarization antennas. The tone pitch should increase due to the additional received signal.
6	Weatherproof the antenna connections at the ‘H’ and ‘V’ interfaces of the ODUs, as described in Connecting the ODU and antenna on page 5-29.

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Task 9: Disarm after alignment

This task consists of the following procedure:

- Disarming the unit on page 6-78

Disarming the unit

When the alignment process is complete, disarm both units in the link. This is necessary in order to:

- Turn off the audible alignment aid
- Enable Adaptive Modulation
- Fully enable Advanced Spectrum Management with i-DFS
- Clear unwanted installation information from the various systems statistics
- Store the link range for fast link acquisition on link drop
- Enable higher data rates

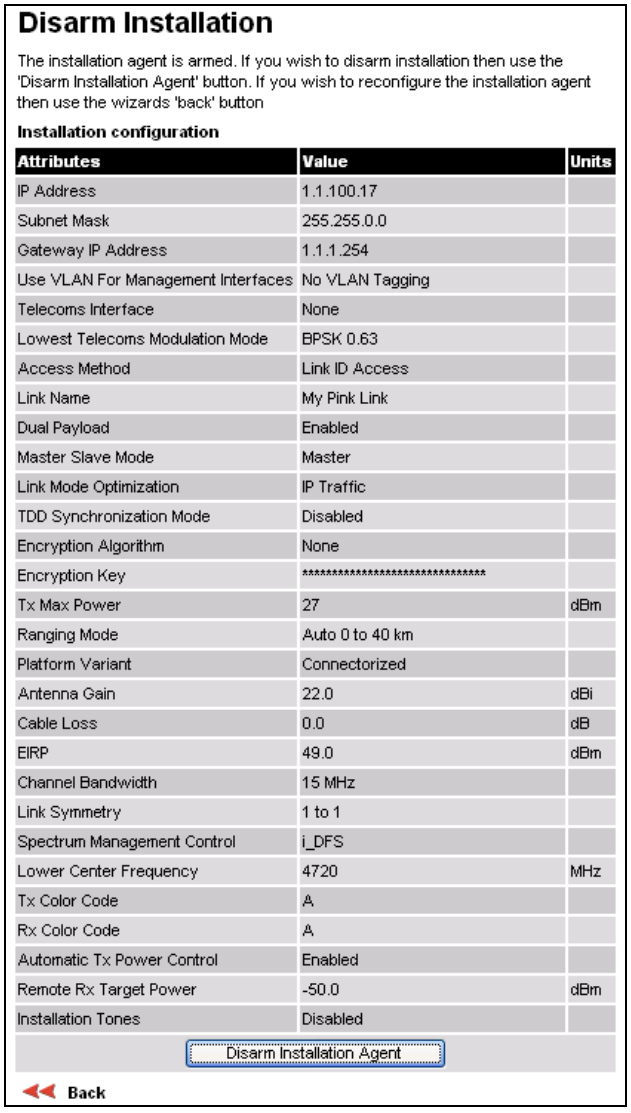
NOTE

After 24 hours, the units will be disarmed automatically, provided that they are armed and that the link is up.

When the Installation wizard is complete, the unit is armed and rebooted. When the unit has rebooted, select menu option **Installation**. The Disarm installation page is displayed (Figure 6-42).

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Figure 6-42 Disarm Installation page



Disarm Installation

The installation agent is armed. If you wish to disarm installation then use the 'Disarm Installation Agent' button. If you wish to reconfigure the installation agent then use the wizards 'back' button

Installation configuration

Attributes	Value	Units
IP Address	1.1.100.17	
Subnet Mask	255.255.0.0	
Gateway IP Address	1.1.1.254	
Use VLAN For Management Interfaces	No VLAN Tagging	
Telecoms Interface	None	
Lowest Telecoms Modulation Mode	BPSK 0.63	
Access Method	Link ID Access	
Link Name	My Pink Link	
Dual Payload	Enabled	
Master Slave Mode	Master	
Link Mode Optimization	IP Traffic	
TDD Synchronization Mode	Disabled	
Encryption Algorithm	None	
Encryption Key	**********	
Tx Max Power	27	dBm
Ranging Mode	Auto 0 to 40 km	
Platform Variant	Connectorized	
Antenna Gain	22.0	dBi
Cable Loss	0.0	dB
EIRP	49.0	dBm
Channel Bandwidth	15 MHz	
Link Symmetry	1 to 1	
Spectrum Management Control	i_DFS	
Lower Center Frequency	4720	MHz
Tx Color Code	A	
Rx Color Code	A	
Automatic Tx Power Control	Enabled	
Remote Rx Target Power	-50.0	dBm
Installation Tones	Disabled	

Disarm Installation Agent

Back

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To complete the installation process, select **Disarm Installation Agent**. One of two possible confirmation pages are displayed (Figure 6-43 or Figure 6-44). These present hyperlinks to the main configuration and spectrum management pages.

Figure 6-43 Optional post-disarm configuration 1

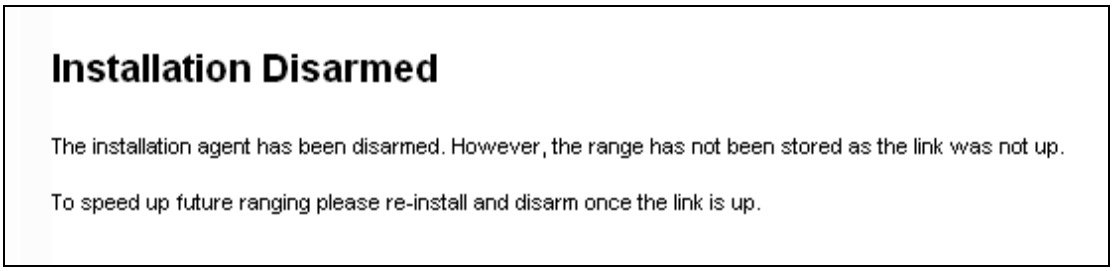
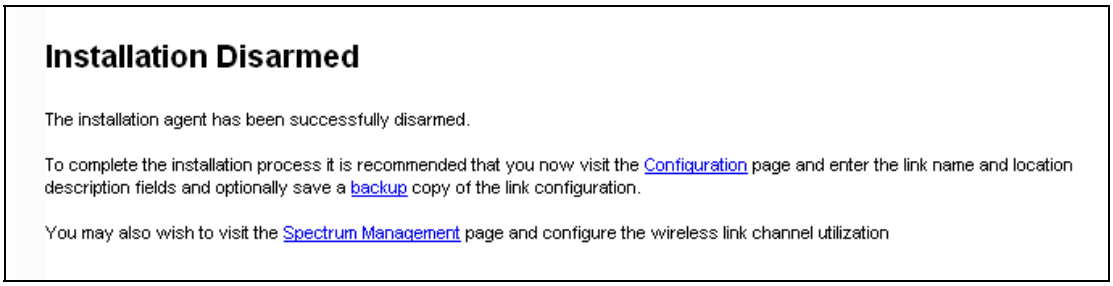


Figure 6-44 Optional post-disarm configuration 2



NOTE

The installation process is completed when both ends of the link are ‘disarmed’.

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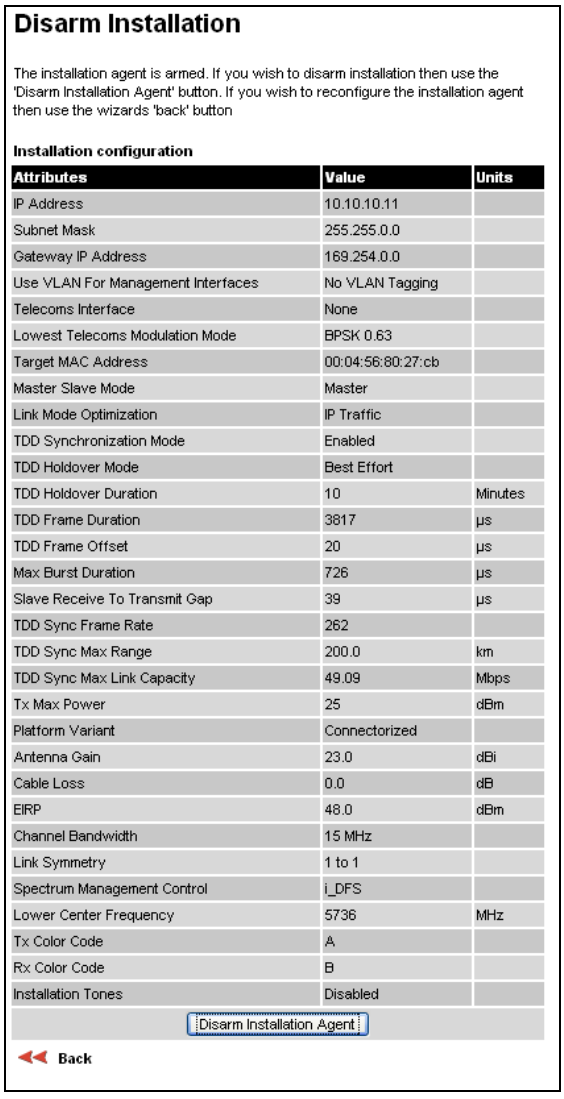
Disarm ODU following TDD synchronization configuration

If TDD synchronization has been enabled, the Disarm Installation page contains TDD attributes (Figure 6-45).

⚠ CAUTION

In a synchronized network, links MUST be configured separately before bringing the whole network up.

Figure 6-45 Disarm following TDD synchronization



Disarm Installation

The installation agent is armed. If you wish to disarm installation then use the 'Disarm Installation Agent' button. If you wish to reconfigure the installation agent then use the wizards 'back' button

Installation configuration

Attributes	Value	Units
IP Address	10.10.10.11	
Subnet Mask	255.255.0.0	
Gateway IP Address	169.254.0.0	
Use VLAN For Management Interfaces	No VLAN Tagging	
Telecoms Interface	None	
Lowest Telecoms Modulation Mode	BPSK 0.63	
Target MAC Address	00:04:56:80:27:cb	
Master Slave Mode	Master	
Link Mode Optimization	IP Traffic	
TDD Synchronization Mode	Enabled	
TDD Holdover Mode	Best Effort	
TDD Holdover Duration	10	Minutes
TDD Frame Duration	3817	µs
TDD Frame Offset	20	µs
Max Burst Duration	726	µs
Slave Receive To Transmit Gap	39	µs
TDD Sync Frame Rate	262	
TDD Sync Max Range	200.0	km
TDD Sync Max Link Capacity	49.09	Mbps
Tx Max Power	25	dBm
Platform Variant	Connectorized	
Antenna Gain	23.0	dBi
Cable Loss	0.0	dB
EIRP	48.0	dBm
Channel Bandwidth	15 MHz	
Link Symmetry	1 to 1	
Spectrum Management Control	i_DFS	
Lower Center Frequency	5736	MHz
Tx Color Code	A	
Rx Color Code	B	
Installation Tones	Disabled	

Disarm Installation Agent

Back

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Task 10: Check link performance

This task consists of the following procedure:

- Adjusting power settings on page 6-82

Adjusting power settings

The transmit power levels of the installed units must be adjusted to ensure they are not too high. Excessive power levels may cause saturation of the receivers or false radar detection (in radar enabled regions), leading to degradation of link performance and link failure.

NOTE

To adjust the transmit power levels of the local and remote units, select **Configuration** from the menu, then update the Max Transmit Power attribute.

To adjust power levels, proceed as follows:

Procedure 6-30 Adjust power levels

1	Consult the report generated by the Link Planner tool and note the Transmit power recommended levels.
2	Set the local unit power equal to the 'LOCAL - Max Transmit Power setting while pointing' value from the Link Planner report.
3	Set the remote unit power equal to the 'REMOTE - Max Transmit Power setting while pointing' value from the Link Planner report.
4	Access each unit separately.
5	Align the units as described in Aligning the units on page 6-74.
6	Repeat Step 2 and 3 using the values 'LOCAL - Max Transmit Power setting before disarm' and 'REMOTE - Max Transmit Power setting before disarm', if different than the corresponding 'while pointing' values.
7	Reboot the local unit then reboot the remote unit.
8	Disarm the units.

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Task 11: Connect link to the network

This task consists of the following procedures:

- Connecting to the network on page 6-83
- Setting the real-time clock on page 6-84

Connecting to the network

To connect to the network, proceed as follows:

Procedure 6-31 Connect to network – in-band management

1	Disconnect the local PC from the PIDU Plus at the Master and Slave sites.
2	At each site, connect the PIDU Plus LAN ports to a router port, switch port or other network equipment in the data network using the CAT5e cable that was prepared for this purpose in Preparing the PIDU Plus to LAN cable on page 5-27.
3	Check that the Master and Slave units are reachable from the network management system by opening the web interface to the management agents, or by requesting ICMP echo response packets using the Ping application. The network management system will normally be geographically remote from the sites, so it may be necessary to request that this action is completed by co-workers at the management centre. Alternatively, it may be possible to use remote login to the management system.
4	Check the data network for correct operation across the wireless link. This may be by requesting ICMP echo response packets between hosts in the connected network segments, or by some more structured use of network testing tools.

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Setting the real-time clock

Perform this task to set the real-time clock of the PTP 600.

The clock supplies accurate date and time information to the system. It can be set to run with or without a connection to a network time server (SNTP):

- In the absence of an SNTP server connection, the clock can be set to run manually. The clock is battery backed and will continue to operate for several days after the ODU is switched off.
- If an SNTP server connection is available, the clock can be set to synchronize with the server time at regular intervals.

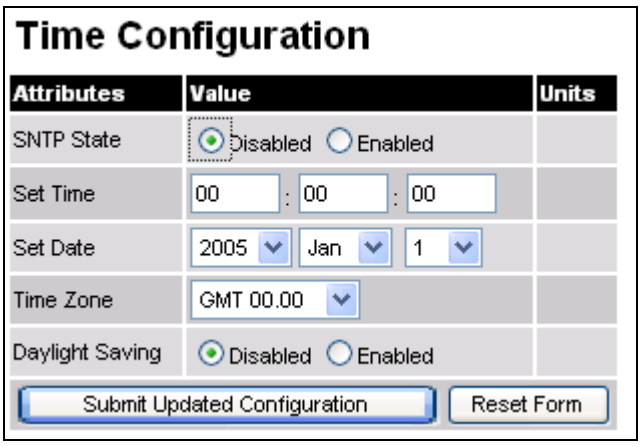
Setting the real-time clock manually

To set the clock to keep time without connecting to a networked time server, proceed as follows:

Procedure 6-32 Set the real-time clock manually

1	Select menu option **Management, Time.** The Time Configuration page is displayed (Figure 6-46).
2	Set the SNTP State attribute to **Disabled**. The manual clock attributes are displayed.
3	Review and update the manual clock attributes (Table 6-14).
4	Select **Submit Updated Configuration**.

Figure 6-46 Time Configuration page (SNTP disabled)



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Table 6-14 Manual clock attributes

Attribute	Meaning
SNTP State	'Disabled' means that the PTP 600 will keep time without connecting to a networked time server.
Set Time	Set hours, minutes and seconds.
Set Date	Set year, month and day.
Time Zone	Set the time zone offset from Greenwich Mean Time (GMT).
Daylight Saving	'Disabled' means that daylight saving adjustments will not be applied to the time. 'Enabled' means that daylight saving adjustments will be applied, according to local rules.

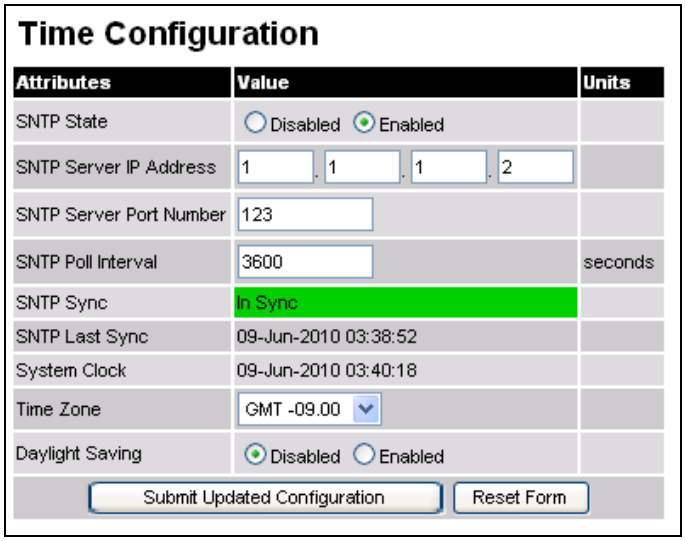
Setting the real-time clock to synchronize using SNTP

To set the clock to synchronize with a networked time server, proceed as follows:

Procedure 6-33 Set the real-time clock using SNTP

1	Select menu option **Management, Time.** The Time Configuration page is displayed.
2	Set the SNTP State attribute to **Enabled**. The SNTP clock attributes are displayed (Figure 6-47).
3	Review and update the SNTP clock attributes (Table 6-15).
4	Select **Submit Updated Configuration**.

Figure 6-47 Time Configuration page (SNTP enabled)



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Table 6-15 SNTP clock attributes

Attribute	Meaning
SNTP State	'Enabled' means that the ODU will obtain accurate date and time updates from a networked time server.
SNTP Server IP Address	Enter the IP address of the networked SNTP server.
SNTP Server Port Number	Enter the port number of the networked SNTP server. By convention the default value for the port number is 123.
SNTP Poll Interval	Enter the period at which the SNTP client polls the server for time correction updates (default 1 hour). If an SNTP poll fails, the client will automatically perform three retries before waiting for the user defined poll period.
SNTP Sync	This shows the current status of SNTP synchronization. If 'No Sync' is displayed, then review the SNTP Server IP Address and Port Number. A change of state may generate an SNMP trap or SMTP email alert.
SNTP Last Sync	This shows the date and time of the last SNTP synchronization.
System Clock	This displays the local time, allowing for the Time Zone and Daylight Saving settings.
Time Zone	Set the time zone offset from Greenwich Mean Time (GMT).
Daylight Saving	'Disabled' means that daylight saving adjustments will not be applied to the time. 'Enabled' means that daylight saving adjustments will be applied to the time, according to local rules.

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Task 12: Configure RADIUS

This task is only performed when the PTP 600 link requires RADIUS authentication.

RADIUS authentication is only available when PTP 600 is configured for Identity-based User Accounts and when RADIUS servers are connected to the network.

This task consists of the following procedure:

- Configuring RADIUS authentication on page 6-87

Configuring RADIUS authentication

Only users with Security Officer role are permitted to configure RADIUS authentication.

NOTE

When RADIUS is enabled, the Security Officer may disable all local user accounts, as described in Creating or updating identity-based users on page 6-42.

NOTE

At least one user with Security Officer privileges must exist, and be enabled, in order to disable the RADIUS client.

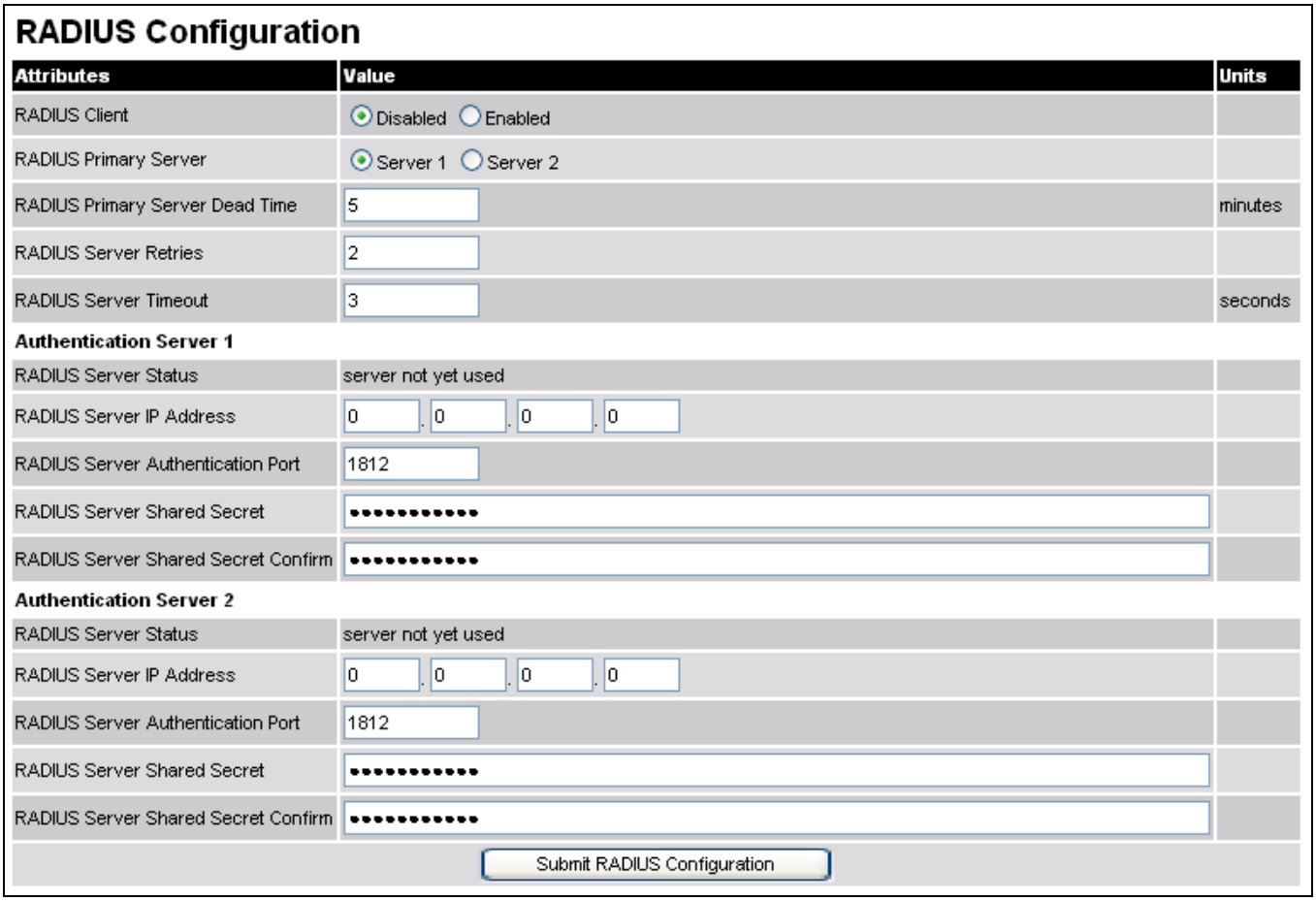
To configure RADIUS, proceed as follows:

Procedure 6-34 Configure RADIUS

1	Select menu option **Management, Web, Radius Config**. The RADIUS Authentication page is displayed (Figure 6-48).
2	Update the attributes as required (Table 6-16).
3	Select **Submit RADIUS Configuration**.

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Figure 6-48 RADIUS Authentication page



RADIUS Configuration

Attributes	Value	Units
RADIUS Client	◉ Disabled ○ Enabled	
RADIUS Primary Server	◉ Server 1 ○ Server 2	
RADIUS Primary Server Dead Time	5	minutes
RADIUS Server Retries	2	
RADIUS Server Timeout	3	seconds
Authentication Server 1		
RADIUS Server Status	server not yet used	
RADIUS Server IP Address	0 . 0 . 0 . 0	
RADIUS Server Authentication Port	1812	
RADIUS Server Shared Secret	••••••••••••	
RADIUS Server Shared Secret Confirm	••••••••••••	
Authentication Server 2		
RADIUS Server Status	server not yet used	
RADIUS Server IP Address	0 . 0 . 0 . 0	
RADIUS Server Authentication Port	1812	
RADIUS Server Shared Secret	••••••••••••	
RADIUS Server Shared Secret Confirm	••••••••••••	

Submit RADIUS Configuration

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Table 6-16 RADIUS Authentication attributes

Attribute	Meaning
RADIUS Client Enabled	'Enabled' means that PTP 600 users may be authenticated via the RADIUS servers. 'Disabled' may only be selected if at least one user with Security Officer privileges exists.
RADIUS Primary Server	Specifies the primary server, determining the order in which the servers are tried.
RADIUS Primary Server Dead Time	Time (in minutes) to hold off trying to communicate with a previously unavailable RADIUS server. Setting the value to zero disables the timer.
RADIUS Server Retries	Number of times the PTP 600 will retry after a RADIUS server fails to respond to an initial request.
RADIUS Server Timeout	Time (in seconds) the PTP 600 will wait for a response from a RADIUS server.
Authentication Server 1 and 2:	
RADIUS Server Status	The status of the RADIUS server. This contains the time of the last test and an indication of success or failure. If the Authentication Server attributes are incorrect, the displayed status is 'server config not valid'.
RADIUS Server IP Address	IP address of the RADIUS server.
RADIUS Server Authentication Port	Network port used by RADIUS server for authentication services.
RADIUS Server Shared Secret	Shared secret used in RADIUS server communications. May contain alphabetic, numeric, special characters or spaces, but not extended unicode characters. The maximum length is 127 characters.
RADIUS Server Shared Secret Confirm	Shared secret confirmation.

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Task 13: Set up SNMP agent

If SNMP is enabled, when an event occurs, the SNMP agent on the PTP 600 sends a trap to whatever SNMP trap receivers have been configured.

Depending upon which SNMP version is required, choose one of the following procedures::

- Configuring generation of SNMPv3 notifications on page 6-90
- Configuring generation of SNMPv1/2c notifications on page 6-99

Configuring generation of SNMPv3 notifications

Perform this task to enable the PTP 600 to generate Simple Network Management Protocol version 3 (SNMPv3) traps.

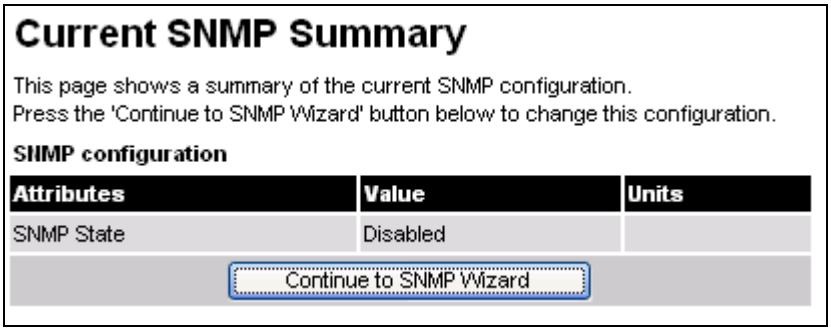
Starting SNMP wizard

To start the SNMP wizard, proceed as follows:

Procedure 6-35 Start SNMP wizard

1	Select menu option **Management, SNMP**. The Current SNMP Summary page is displayed (Figure 6-49).
2	Review the summary.
3	If any updates are required, select **Continue to SNMP Wizard**.

Figure 6-49 Current SNMP Summary page (when SNMP is disabled)



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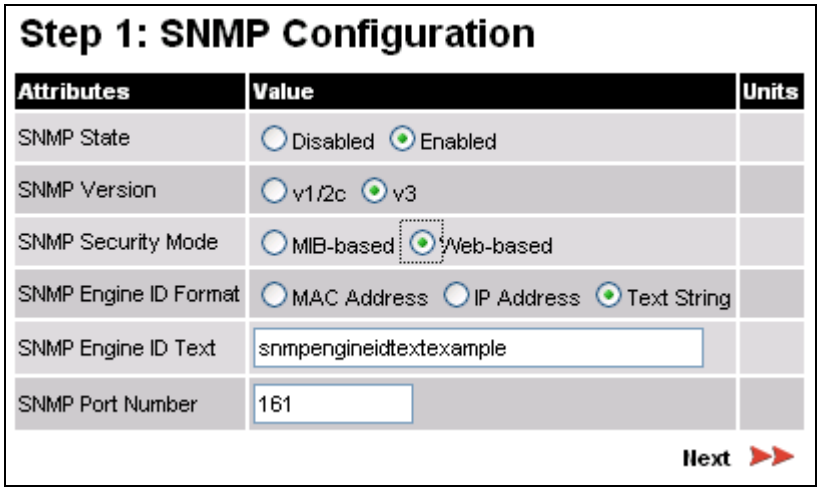
Step 1: SNMP configuration (for SNMPv3)

To configure SNMPv3 notifications, proceed as follows:

Procedure 6-36 Configure SNMP notifications (for SNMPv3)

1	When the Step 1: SNMP Configuration page is displayed, set SNMP State to 'Enabled' and set SNMP Version to 'v3'. The page is redisplayed with SNMPv3 attributes (Figure 6-50).
2	Update the attributes (Table 6-17).
3	Select **Next**.
4	The next step depends upon which SNMP Security Mode is selected: If it is 'Web-based', go to Step 2: SNMP user policy configuration (for SNMPv3) on page 6-92. If it is 'MIB-based', go to Confirming SNMP configuration (for SNMPv3) on page 6-97.

Figure 6-50 Step 1: SNMP Configuration page (for SNMPv3)



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Table 6-17 Step 1: SNMP Configuration attributes (for SNMPv3)

Attribute	Meaning
SNMP Security Mode	'MIB-based' means that SNMPv3 security parameters are managed via SNMP MIBs. 'Web-based' means that the SNMPv3 security parameters are not available over SNMP, but instead are configured using the SNMP Accounts page, as described in Step 2: SNMP user policy configuration (for SNMPv3) on page 6-92.
SNMP Engine ID Format	Specifies whether the Engine ID is generated from the MAC Address, IP Address or Text String.
SNMP Engine ID Text	Only enabled when SNMP Engine ID Format is set to 'Text String'. Text used to generate the SNMP Engine ID.
SNMP Port Number	Enter the port that the SNMP agent is listening to for commands from a management system.

Step 2: SNMP user policy configuration (for SNMPv3)

If the chosen SNMP Security Mode is 'Web-based', then SNMP user accounts must be configured to access the PTP 600. SNMP users may have one of two security profiles: 'System administrator' or 'Read only'.

To configure SNMP accounts, proceed as follows:

Procedure 6-37 Configure SNMP user policy (for SNMPv3)

1	The Step 2: SNMP User Policy Configuration page is displayed (Figure 6-51).
2	Update the web-based security profile attributes (Table 6-18). These will determine which authentication and privacy protocols are required for SNMP users with roles 'System administrator' and 'Read only'.
3	Select **Next**.

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Figure 6-51 Step 2: SNMP User Policy Configuration page (for SNMPv3)

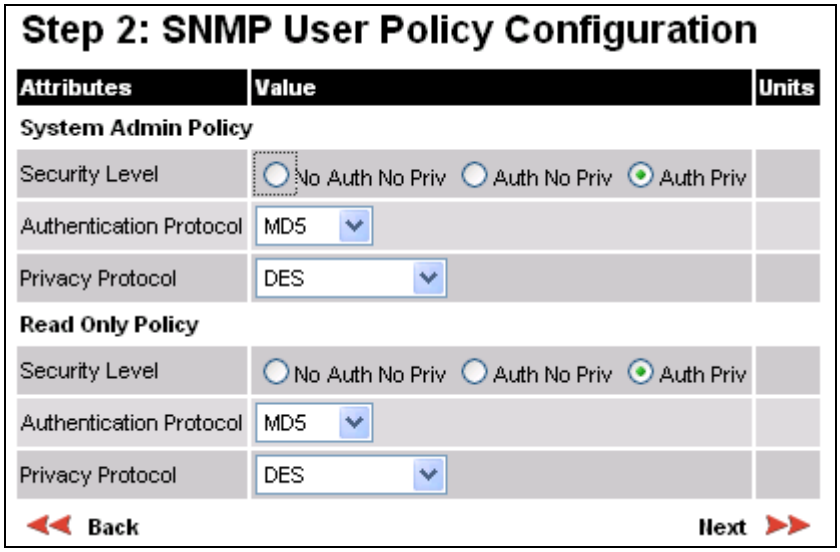


Table 6-18 Step 2: SNMP User Policy Configuration attributes (for SNMPv3)

Attribute	Meaning
Security Level	Defines the security level and associated protocols that are required to allow SNMP users to access the PTP 600. 'No Auth No Priv' means that users are not required to use authentication or privacy protocols. 'Auth No Priv' means that users are required to use only authentication protocols. 'Auth Priv' means that users are required to use both authentication and privacy protocols.
Authentication Protocol	The authentication protocol to be used to access the PTP 600 via SNMP. This is disabled when Security Level is set to 'No Auth No Priv'. 'MD5' means Message Digest Algorithm. 'SHA' means NIST FIPS 180-1, Secure Hash Algorithm SHA-1.

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Attribute	Meaning
Privacy Protocol	The privacy protocol to be used to access the PTP 600 via SNMP. This is disabled when Security Level is set to 'No Auth No Priv' or 'Auth No Priv'. 'DES' means Data Encryption Standard (DES) symmetric encryption protocol. 'AES' means Advanced Encryption Standard (AES) cipher algorithm. **NOTE** A user configured to use AES privacy protocol will not be able to transmit and receive encrypted messages unless the license key enables the AES capability.

Step 3: SNMP user accounts configuration (for SNMPv3)

To configure SNMP user accounts, proceed as follows:

Procedure 6-38 Configure SNMP user accounts (for SNMPv3)

1	The Step 3: SNMP User Accounts Configuration page is displayed (Figure 6-52).
2	Update the individual user attributes (Table 6-19) for up to 10 SNMP users.
3	Select **Next**.

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Figure 6-52 Step 3: SNMP User Accounts Configuration page (for SNMPv3)

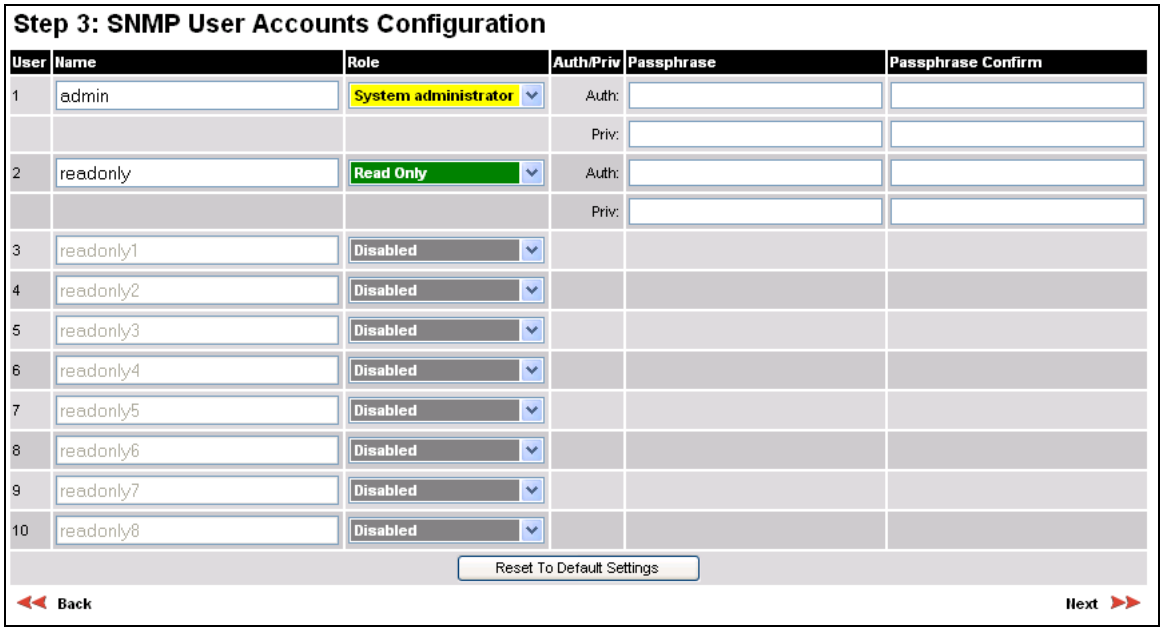


Table 6-19 Step 3: SNMP User Accounts Configuration attributes (for SNMPv3)

Attribute	Meaning
Name	Name to be used by the SNMP user to access the system.
Role	Selects which of the two web-based security profiles are applied to this user: 'System administrator' or 'Read only'. Select 'Disabled' to disable the SNMP account.
Auth/Priv	Indicates whether the Passphrase applies to authentication or privacy protocols.
Passphrase	The phrase to be entered by this SNMP user to access the system using an authentication or privacy protocol. Length must be between 8 and 32 characters. May contain spaces. The 'Auth:' Passphrase is hidden when Security Level for this user's Role is set to 'No Auth No Priv'. The 'Priv:' Passphrase is hidden when Security Level for this user's Role is set to 'No Auth No Priv' or 'Auth No Priv'.
Passphrase Confirm	Passphrase must be reentered to confirm it has not been mis-keyed.

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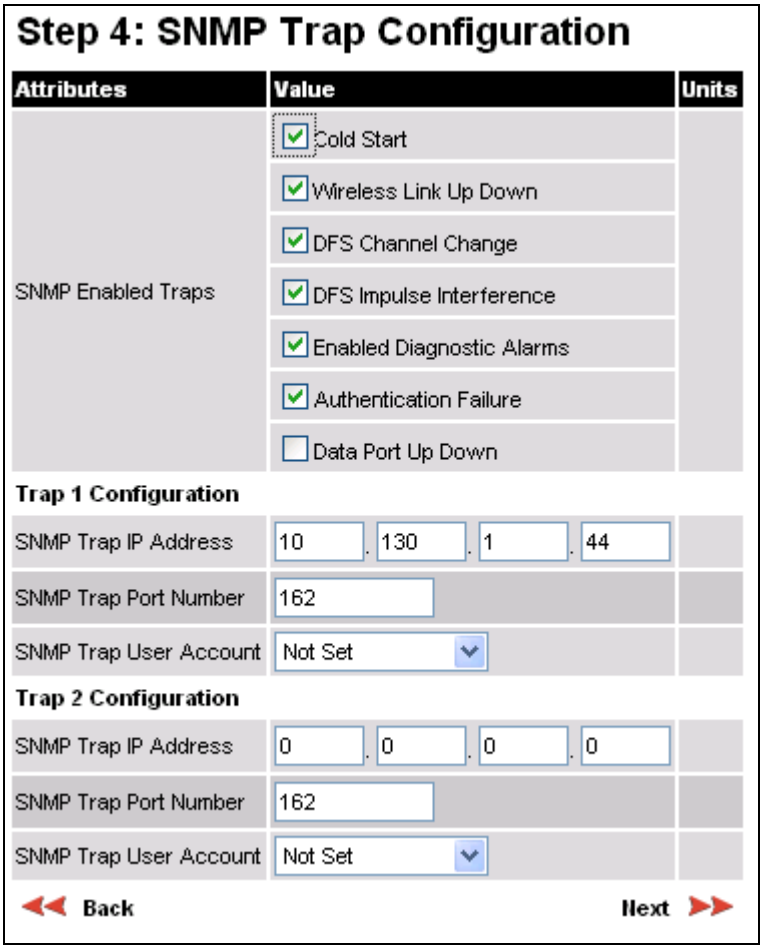
Step 4: SNMP trap configuration (for SNMPv3)

To configure SNMP traps, proceed as follows:

Procedure 6-39 Configure SNMP traps (for SNMPv3)

1	The Step 4: SNMP Trap Configuration page is displayed (Figure 6-53).
2	Update the attributes (Table 6-20).
3	Select **Next**.

Figure 6-53 Step 4: SNMP Trap Configuration page (for SNMPv3)



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Table 6-20 Step 4: SNMP Trap Configuration attributes (for SNMPv3)

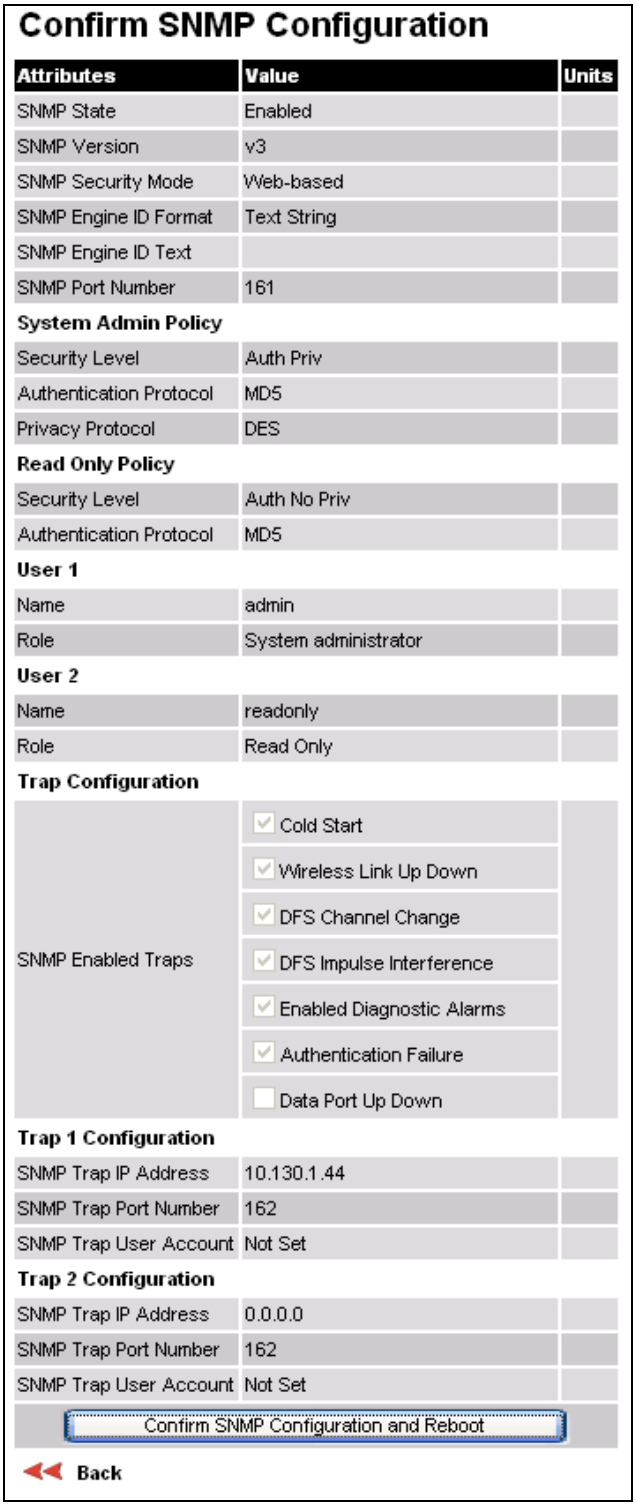
Attribute	Meaning
SNMP Enabled Traps	Select the events that will generate SNMP traps.
SNMP Trap IP Address 1	The IP address of the first SNMP server (trap receiver). This will normally be the network management system, but it may be a separate trap receiver. Enter zeros to disable logging on the first SNMP server.
SNMP Trap Port Number 1	The server 1 port at which SNMP traps are received.
SNMP Trap User Account 1	The user name (and associated protocols) to use when sending SNMP traps to server 1.
SNMP Trap IP Address 2	The IP address of the second SNMP server (trap receiver). This will normally be the network management system, but it may be a separate trap receiver. Enter zeros to disable logging on the second SNMP server.
SNMP Trap Port Number 2	The server 2 port at which SNMP traps are received.
SNMP Trap User Account 2	The user name (and associated protocols) to use when sending SNMP traps to server 2.

Confirming SNMP configuration (for SNMPv3)

When the Confirm SNMP Configuration page (Figure 6-54) is displayed, review the settings and select either **Back** or **Confirm SNMP Configuration and Reboot**. When the settings are confirmed, the unit reboots.

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Figure 6-54 Confirm SNMP Configuration page (for SNMPv3)



Confirm SNMP Configuration

Attributes	Value	Units
SNMP State	Enabled	
SNMP Version	v3	
SNMP Security Mode	Web-based	
SNMP Engine ID Format	Text String	
SNMP Engine ID Text		
SNMP Port Number	161	
System Admin Policy		
Security Level	Auth Priv	
Authentication Protocol	MD5	
Privacy Protocol	DES	
Read Only Policy		
Security Level	Auth No Priv	
Authentication Protocol	MD5	
User 1		
Name	admin	
Role	System administrator	
User 2		
Name	readonly	
Role	Read Only	
Trap Configuration		
SNMP Enabled Traps	☑ Cold Start	
	☑ Wireless Link Up Down	
	☑ DFS Channel Change	
	☑ DFS Impulse Interference	
	☑ Enabled Diagnostic Alarms	
	☑ Authentication Failure	
	☐ Data Port Up Down	
Trap 1 Configuration		
SNMP Trap IP Address	10.130.1.44	
SNMP Trap Port Number	162	
SNMP Trap User Account	Not Set	
Trap 2 Configuration		
SNMP Trap IP Address	0.0.0.0	
SNMP Trap Port Number	162	
SNMP Trap User Account	Not Set	

Confirm SNMP Configuration and Reboot

Back

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Configuring generation of SNMPv1 / 2c notifications

Perform this task to enable the PTP 600 to generate Simple Network Management Protocol version 1 or 2c (SNMPv1 or SNMPv2c) traps.

Start SNMP wizard

To start the SNMP wizard, proceed as follows:

Procedure 6-40 Start SNMP wizard

1	Select menu option **Management, SNMP**. The Current SNMP Summary page is displayed (Figure 6-49).
2	Review the summary.
3	If any updates are required, select **Continue to SNMP Wizard**.

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Step 1: SNMP Configuration (for SNMPv1/2c)

To configure SNMPv1 or SNMPv2c notifications, proceed as follows:

Procedure 6-41 Configure SNMP notifications (for SNMPv1/2c)

1	When the Step 1: SNMP Configuration page is displayed, set SNMP State to 'Enabled' and set SNMP Version to 'v1/2c'. The page is redisplayed with SNMPv1/2c attributes (Figure 6-55).
2	Update the attributes (Table 6-21).
3	Select **Next**.

Figure 6-55 Step 1: SNMP Configuration page (for SNMPv1/2c)

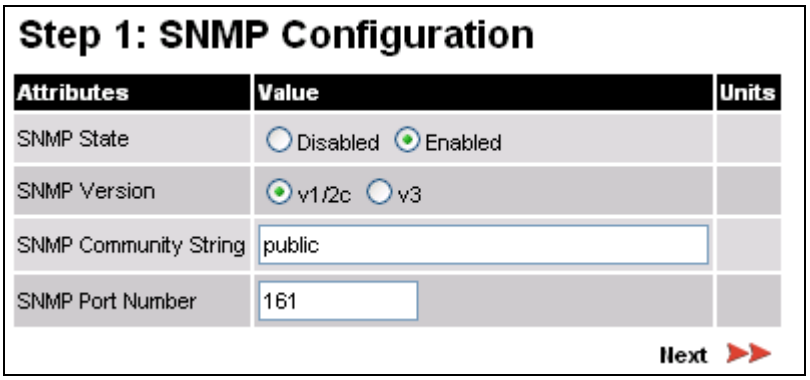


Table 6-21 Step 1: SNMP Configuration attributes (for SNMPv1/2c)

Attribute	Meaning
SNMP Community String	The SNMP community string acts like a password between the network management system and the distributed SNMP clients (PTP 600 ODUs). Only if the community string is configured correctly on all SNMP entities can the flow of management information take place. By convention the default value is set to 'public'.
SNMP Port Number	Enter the port that the SNMP agent is listening to for commands from a management system.

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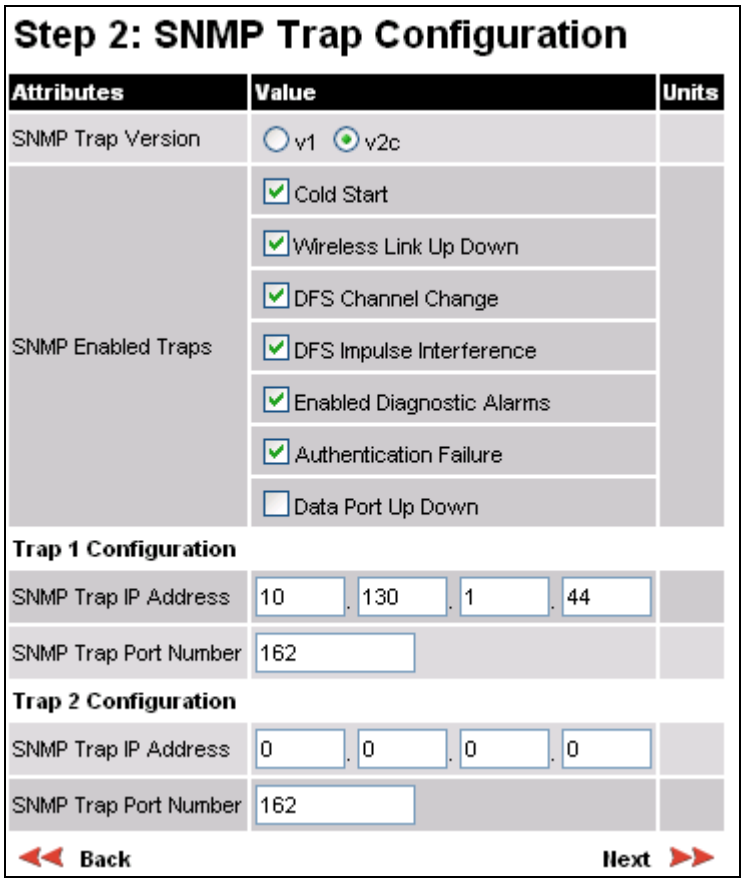
Step 2: SNMP Trap Configuration (for SNMPv1/2c)

To configure SNMP traps, proceed as follows:

Procedure 6-42 Configure SNMP traps (for SNMPv1/2c)

1	The Step 2: SNMP Trap Configuration page is displayed (Figure 6-56).
2	Update the attributes (Table 6-22).
3	Select **Next**.

Figure 6-56 Step 2: SNMP Trap Configuration page (for SNMPv1/2c)



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Table 6-22 Step 2: SNMP Trap Configuration attributes (for SNMPv1/2c)

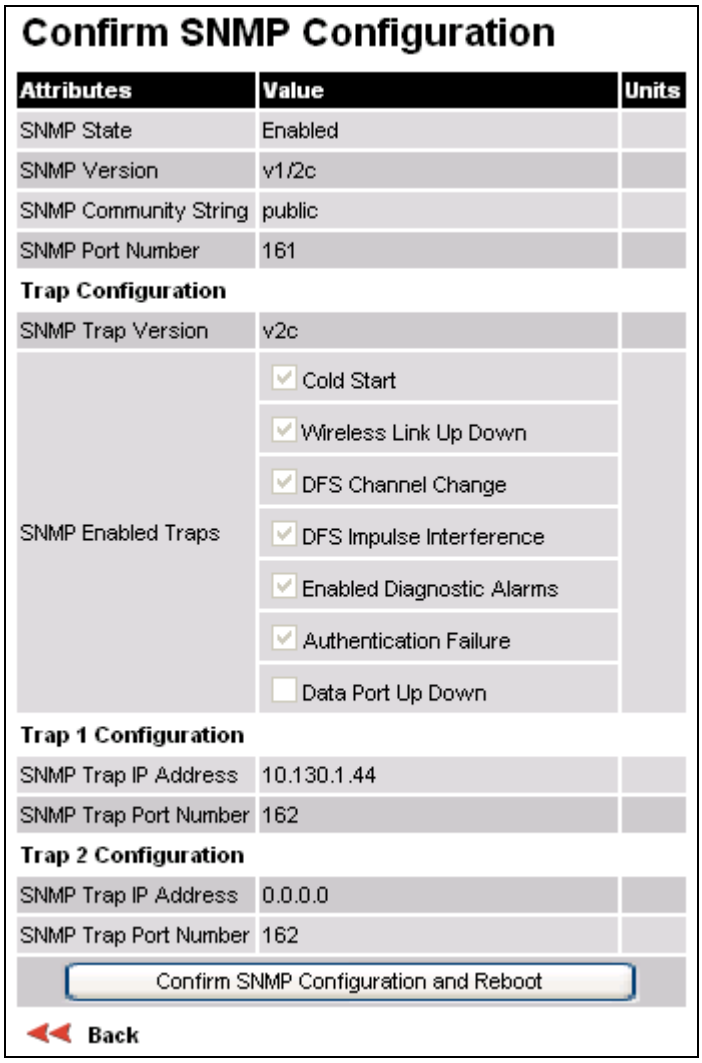
Attribute	Meaning
SNMP Trap Version	Select the SNMP protocol version to use for SNMP traps: ‘v1’ or ‘v2c’.
SNMP Enabled Traps	Select the events that will generate SNMP traps.
SNMP Trap IP Address 1	The IP address of the first SNMP server (trap receiver). This will normally be the network management system, but it may be a separate trap receiver. Enter zeros to disable logging on the first SNMP server.
SNMP Trap Port Number 1	The server 1 port at which SNMP traps are received.
SNMP Trap IP Address 2	The IP address of the second SNMP server (trap receiver). This will normally be the network management system, but it may be a separate trap receiver. Enter zeros to disable logging on the second SNMP server.
SNMP Trap Port Number 2	The server 2 port at which SNMP traps are received.

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Confirm SNMP Configuration (for SNMPv1/2c)

When the Confirm SNMP Configuration page (Figure 6-57) is displayed, review the settings and select either **Back** or **Confirm SNMP Configuration and Reboot**. When the settings are confirmed, the unit reboots.

Figure 6-57 Confirm SNMP Configuration page (for SNMPv1/2c)



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Task 14: Configure alarms and messages

This task consists of the following procedures:

- Configuring generation of diagnostics alarms on page 6-104
- Configuring generation of email messages on page 6-106

Configuring generation of diagnostics alarms

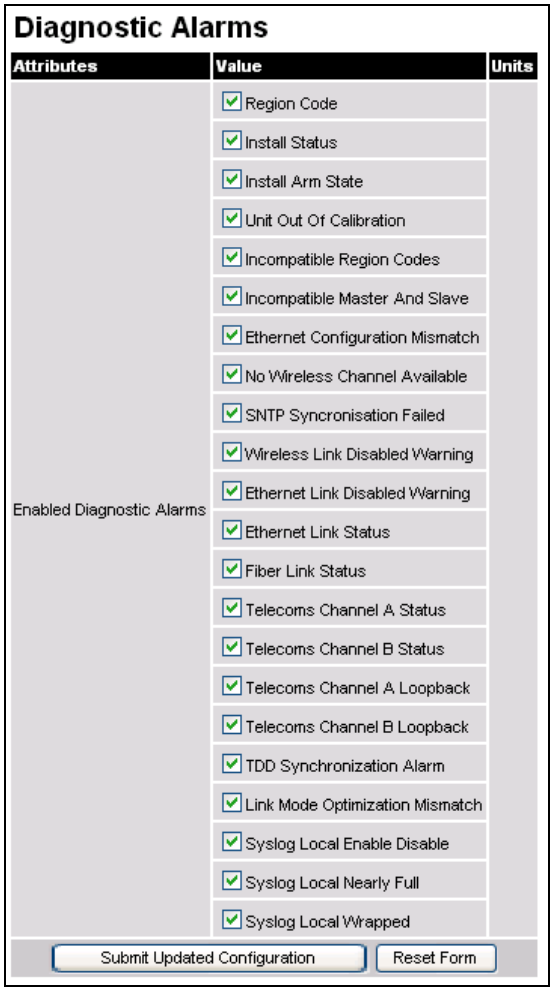
To select which diagnostic alarms will be notified to the system administrator, proceed as follows:

Procedure 6-43 Configure diagnostic alarms

1	Select menu option **Management, Diagnostic Alarms**. The Diagnostic Alarms page is displayed (Figure 6-58).
2	Tick the boxes against the required alarms. These alarms are described in Home page alarm display on page 7-7.
3	Select **Submit Updated Configuration**.

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Figure 6-58 Diagnostic Alarms page



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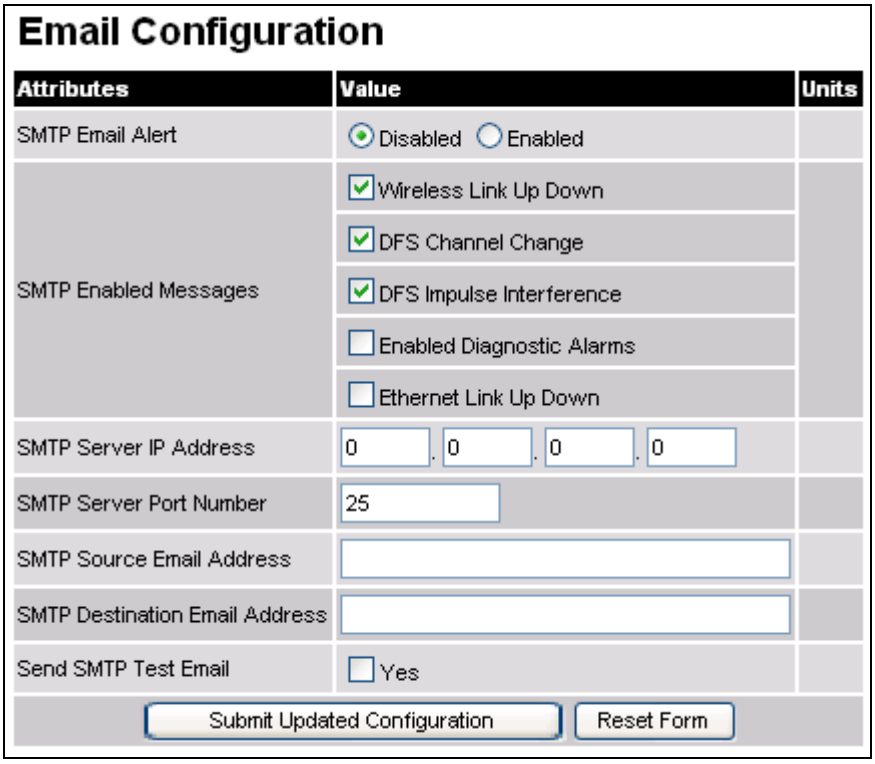
Configuring generation of email messages

To enable the PTP 600 to generate Simple Mail Transfer Protocol (SMTP) email messages to notifiy the system administrator when certain events occur, proceed as follows:

Procedure 6-44 Configure SMTP messages

1	Select menu option **Management, Email**. The Email Configuration page is displayed (Figure 6-59).
2	Update the Email Configuration attributes (Table 6-23).
3	Select **Submit Updated Configuration**. The Configuration Change Reboot dialog is displayed.
4	Select **Reboot Wireless Unit**. The Reboot Confirmation dialog is displayed.
5	Select **OK**. The reboot progress message is displayed. On completion, the unit restarts.

Figure 6-59 Email Configuration page



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Table 6-23 Email Configuration attributes

Attribute	Meaning
SMTP Email Alert	Controls the activation of the SMTP client.
SMTP Enabled Messages	The SMTP Enabled Messages attribute controls which email alerts the unit will send.
SMTP Server IP Address	The IP address of the networked SMTP server.
SMTP Server Port Number	The SMTP Port Number is the port number used by the networked SMTP server. By convention the default value for the port number is 25.
SMTP Source Email Address	The email address used by the PTP 600 Series to log into the SMTP server. This must be a valid email address that will be accepted by your SMTP Server.
SMTP Destination Email Address	The email address to which the PTP 600 Series will send the alert messages.
Send SMTP Test Email	Generate and send an email in order to test the SMTP settings. The tick box will self-clear when **Submit** is selected.

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Task 15: Configure syslog

This task is only performed when system logging is required.

This task consists of the following procedure:

- Configuring system logging (syslog) on page 6-108

Configuring system logging (syslog)

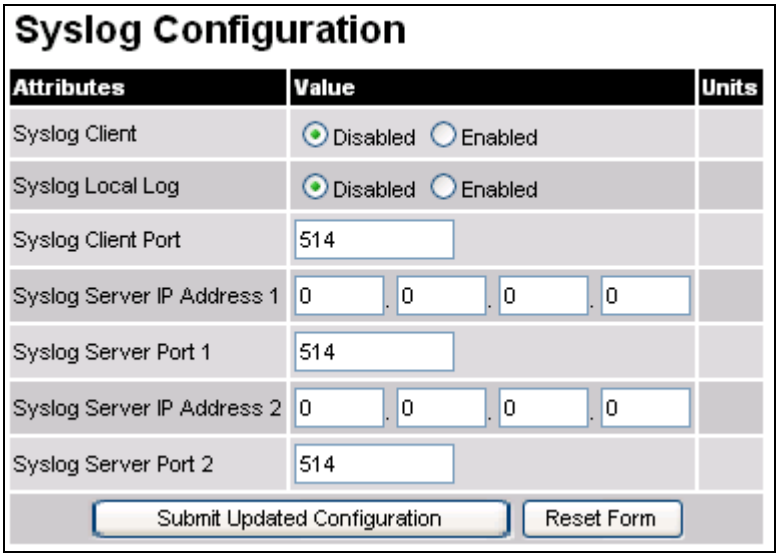
Only users with Security Officer role are permitted to configure the syslog client.

To configure system logging, proceed as follows:

Procedure 6-45 Configure system logging

1	Select menu option **Management, Syslog, Syslog configuration**. The Syslog Configuration page is displayed (Figure 6-60).
2	Update the attributes as required (Table 6-24).
3	Select **Submit Updated Configuration**.

Figure 6-60 Syslog Configuration page



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Table 6-24 Syslog Configuration attributes

Attribute	Meaning
Syslog Client	'Enabled' means that event messages are logged. 'Disabled' means that event messages are not logged.
Syslog Local Log	'Enabled' means that event notification messages are logged locally as well as on the syslog servers. 'Disabled' means that event notification messages are logged only on the syslog servers.
Syslog Client Port	The client port from which syslog messages are sent.
Syslog Server IP Address 1	The IP address of the first syslog server. Enter zeros to disable logging on the first syslog server.
Syslog Server Port 1	The server 1 port at which syslog messages are received.
Syslog Server IP Address 2	The IP address of the second syslog server. Enter zeros to disable logging on the second syslog server.
Syslog Server Port 2	The server 2 port at which syslog messages are received.

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Task 16: Configure remote access

This task consists of the following procedure:

- Configuring HTTP, Telnet and TFTP access on page 6-110

Configuring HTTP, Telnet and TFTP access

The HTTP and Telnet interfaces should be disabled if the HTTPS interface is configured. See Configuring HTTPS/TLS page 6-24.

⚠ CAUTION

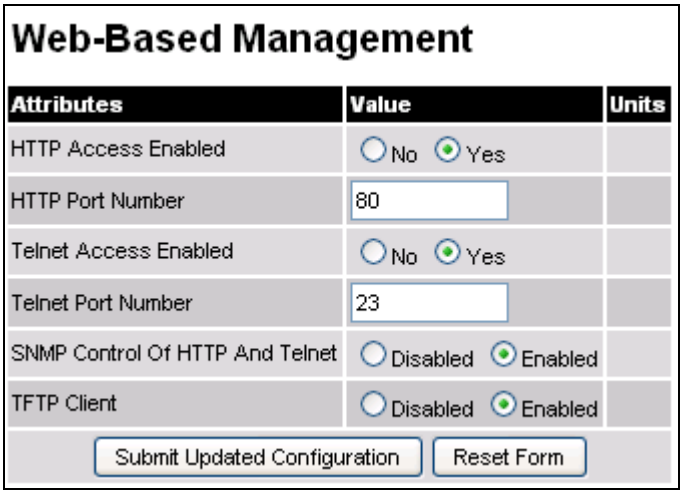
If the HTTP, HTTPS, Telnet and SNMP interfaces are all disabled, then it will be necessary to use the Recovery image to reset IP & Ethernet Configuration back to factory defaults to re-enable the interfaces.

To configure HTTP, Telnet and TFTP access, proceed as follows:

Procedure 6-46 Configure HTTP, Telnet and TFTP access

1	Select menu option **Management, Web**. The Web-Based Management page is displayed (Figure 6-61).
2	Update the attributes as required (Table 6-25).
3	Select **Submit Updated Configuration**.

Figure 6-61 Web-Based Management page



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Table 6-25 Web-Based Management attributes

Attribute	Meaning
HTTPS Access Enabled	Only displayed when HTTPS is configured. Shows the current status of HTTPS access (enabled or not).
HTTPS Port Number	Only displayed when HTTPS is configured. The port number for HTTPS access. A value of zero means the wireless unit uses the default port.
HTTP Access Enabled	'No' means that the unit will not respond to any requests on the HTTP port. 'Yes' means that the unit will respond to requests on the HTTP port. Remote management via HTTPS is not affected by this setting.
HTTP Port Number	The port number for HTTP access. A value of zero means the wireless unit uses the default port.
Telnet Access Enabled	'No' means that the unit will not respond to any requests on the Telnet port. 'Yes' means that the unit will respond to requests on the Telnet port.
Telnet Port Number	The port number for Telnet access. A value of zero means the wireless unit uses the default port.
SNMP Control of HTTP And Telnet	'Disabled' means that neither HTTP nor Telnet can be controlled remotely via SNMP. 'Enabled' means that both HTTP and Telnet can be controlled remotely via SNMP.
TFTP Client	'Disabled' means that the unit will not respond to any TFTP software download requests. 'Enabled' means that software can be downloaded via TFTP, as described in Remote software upgrade by TFTP on page 7-38.

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Chapter 7 Operation

This chapter provides instructions for operators of the PTP 600 web user interface.

The following topics are described in this chapter:

- Web-based management on page 7-2
- Managing spectrum on page 7-22
- Remote software upgrade by TFTP on page 7-38
- Managing security on page 7-40
- Managing performance on page 7-41
- Rebooting the unit on page 7-56

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Web-based management

This section describes the layout and the main menu options of the PTP 600 web-based management interface. The following topics are covered:

- Accessing the web interface on page 7-2
- Menu navigation bar on page 7-3
- Using the menu options on page 7-4
- Viewing the system summary on page 7-6
- Viewing the system status on page 7-11

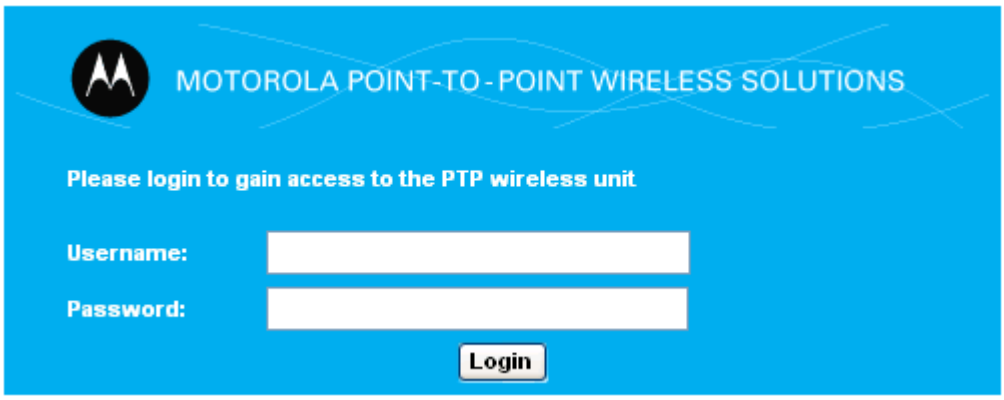
For a general description of the purpose of the web interface, see Web server on page 1-43.

Accessing the web interface

The web interface is best viewed using a screen resolution of at least 1024 x 768 pixels. The web pages have been tested with Internet Explorer 7, Internet Explorer 8, Firefox 3 and Firefox 3.5. Other browsers have not been tested.

To access the web interface, type the IP address of the unit into the browser address bar and press ENTER. The login page is displayed (Figure 7-1). Enter Username (if requested) and Password (if set) and select **Login**.

Figure 7-1 Login page (with username)



⚠ CAUTION

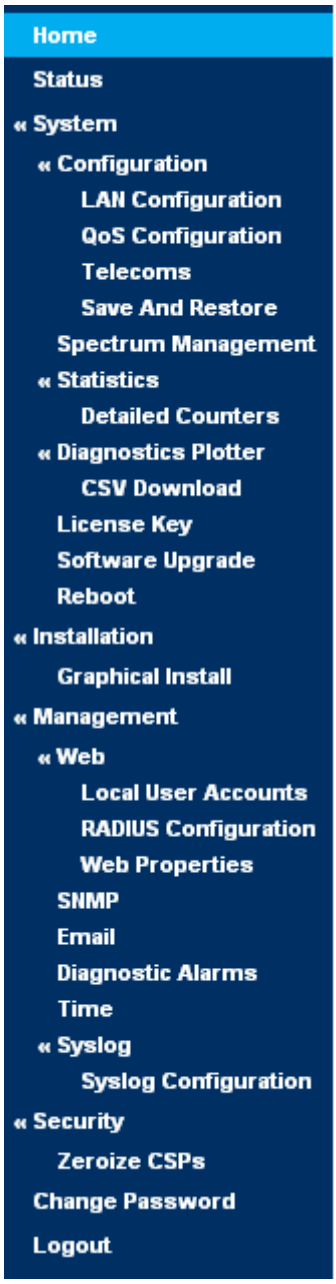
To maintain security, always log out at the end of a session by selecting menu option **Logout**.

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Menu navigation bar

All web pages contain the menu navigation bar on the left hand side (Figure 7-2). The menu is used to navigate to other web pages. The currently selected option is always highlighted with a light blue background.

Figure 7-2 Menu navigation bar



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Using the menu options

Table 7-1 lists the procedures that may be performed from each menu option. Many of these procedures are part of the initial configuration and alignment process described in Chapter 6 Configuration and alignment.

Table 7-1 Procedures performed from each menu option

Menu option	Procedures
Home	Viewing the system summary on page 7-6
Status	Viewing the system status on page 7-11
System	
Configuration	Configuring AES encryption on page 6-22 Updating the system configuration on page 6-46
LAN Configuration	Updating the IP and Ethernet configuration on page 6-6
QoS Configuration	Updating quality of service on page 6-48
SFP Configuration	Refer to *PTP 600 Series Optical Interface Upgrade Kit User Guide (phn-0797)*
Telecoms	Configuring telecoms circuits on page 6-68
Save and Restore	Saving the system configuration on page 6-17 Restoring the configuration file on page 8-28
Spectrum Management	Configuring spectrum usage at the master on page 7-22 Viewing spectrum usage at the slave on page 7-25
Statistics	Checking system statistics on page 7-41 Resetting system histograms and counters on page 7-48
Detailed Counters	Checking detailed counters on page 7-48 Test Ethernet packet errors reported by ODU on page 8-10
Diagnostics Plotter	Using the diagnostics plotter on page 7-52
CSV Download	Downloading diagnostic data on page 7-54
License Key	Checking licensed capabilities on page 6-12 Entering a new license key on page 6-15
Software Upgrade	Upgrading to a new software version on page 6-18

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Menu option	Procedures
Reboot	Rebooting the unit on page 7-56
Installation	Updating wireless configuration on page 6-50 Disarming the unit on page 6-78
Graphical Install	Using the graphical installation option on page 6-72
Management	
Web	Configuring HTTP, Telnet and TFTP access on page 6-110
Local User Accounts	Configuring user accounts on page 6-36 Configuring password complexity on page 6-39 Creating or updating identity-based users on page 6-42
RADIUS Configuration	Configuring RADIUS authentication on page 6-87
Web Properties	Protecting access to the summary and status pages on page 6-45
SNMP	Configuring generation of SNMPv3 notifications on page 6-90 Configuring generation of SNMPv1/2c notifications on page 6-99
Email	Configuring generation of email messages on page 6-106
Diagnostic Alarms	Configuring generation of diagnostics alarms on page 6-104
Time	Setting the real-time clock on page 6-84
Syslog	
Syslog Configuration	Configuring system logging (syslog) on page 6-108
Security	Configuring HTTPS/TLS on page 6-24
Zerioze CSPs	Zeroizing critical security parameters on page 7-40
Change Password	Changing own user password on page 6-44
Logout	

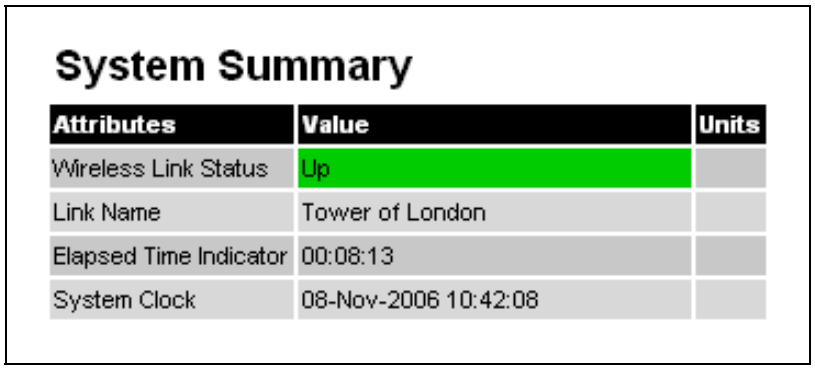
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Viewing the system summary

To display the System Summary page, select menu option **Home**.

The System Summary page (Figure 7-3) contains a high level summary of the status of the wireless link and associated equipment.

Figure 7-3 System Summary page



The attributes of the System Summary page are described in Table 7-2.

Table 7-2 System Summary attributes

Attribute	Meaning
Wireless Link Status	Current status of the wireless link. A green background with status text 'Up' means that the point-to-point link is established. A red background with suitable status text (for example 'Searching') indicates that the link is not established.
Link Name	The name of the PTP link, as set in the System Configuration page.
Elapsed Time Indicator	The time (hh:mm:ss) that has elapsed since the last system reboot. The system can reboot for several reasons, for example, commanded reboot from the system reboot webpage, or a power cycle of the equipment.
System Clock	The system clock presented as local time, allowing for zone and daylight saving.

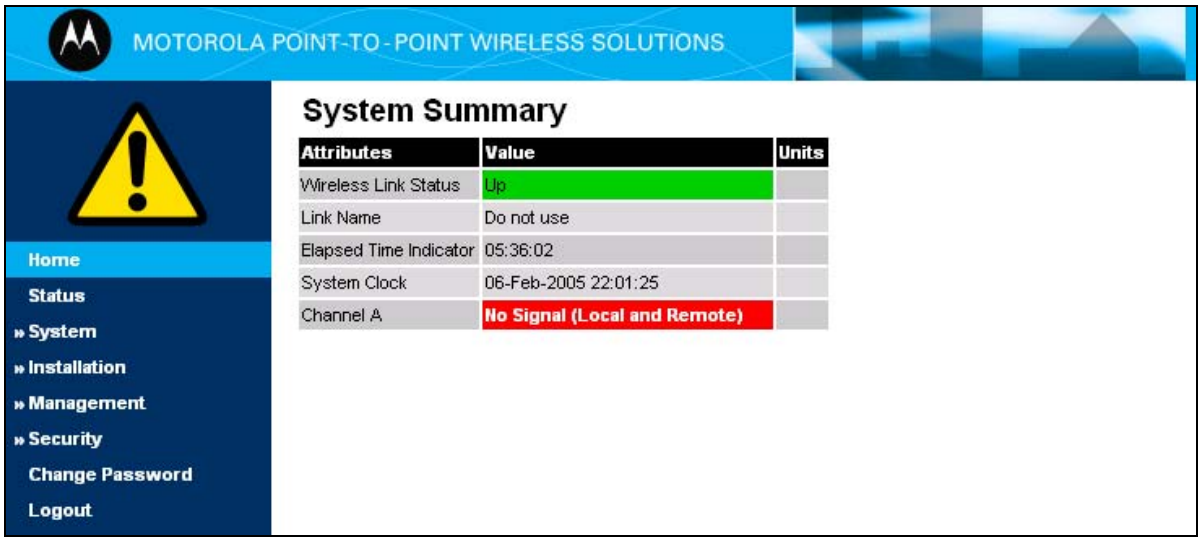
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Attribute	Meaning
Status attributes	Status attributes may be displayed in the System Summary page to indicate abnormal states.

Home page alarm display

The home page is also used to display all outstanding major system alarms. Whenever system alarms are asserted, a yellow warning triangle is displayed on web page navigation bar. The warning triangle will be visible from all web pages. Clicking the warning triangle will cause the web page to jump back to the system homepage. Figure 7-4 shows a sample alarm screen.

Figure 7-4 Alarm warning triangle



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System alarms

The following system alarm attributes may be displayed on the System Summary page:

Region code

The region code prohibits the wireless unit from operating outside the regulated limits. An invalid region code indicates a corrupted license key. Note that a change of state may generate an SNMP trap and/or SMTP email alert.

Install Status

A non-OK value indicates that signaling was received with the wrong MAC address. Note that it is very unusual to detect this, because units with wrongly configured Target MAC Address will normally fail to establish a wireless link. However, rare circumstances may establish a partial wireless link and detect this situation. NB: A non-OK value on start-up, or a change of value during operation, may generate an SNMP trap and/or SMTP email alert.

Install Arm State

This alarm warns when a wireless unit is in installation mode. After installation the wireless unit should be disarmed. This will increase the wireless link's data-carrying capacity and stop the installation tone generator. The wireless link is disarmed from the 'Installation' process, see Disarming the unit on page 6-78. A change of state may generate an SNMP trap and/or SMTP email alert.

Unit Out Of Calibration

The unit is out of calibration and must be returned to the factory using the RMA process for re-calibration.

Incompatible Region Codes

The PTP 600 Series uses region codes to comply with local regulatory requirements governing the transmission of wireless signals in the frequency bands in which it operates. Region codes can only be changed by obtaining a new PTP 600 Series license key. If this alarm is encountered, the appropriate license keys from the country of operation should be obtained from your distributor. Applying license keys containing the same region codes to both ends of the link will remove the alarm. A change of state may generate an SNMP trap and/or SMTP email alert.

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Incompatible Master and Slave

A non-zero value indicates that the master and slave ends of the wireless link are different hardware products, or have different software versions. Note that it is very unusual to detect this because incompatible units will normally fail to establish a wireless link. However, some combinations may establish a partial wireless link and detect this situation. Note that a non-zero value may generate an SNMP trap and/or SMTP email alert.

Ethernet Configuration Mismatch

The detection of Ethernet fragments (runt packets) when the link is in full duplex is an indication of an auto-negotiation or forced configuration mismatch. Note that a change of state may generate an SNMP trap and/or SMTP email alert.

No Wireless Channel Available

Spectrum Management was unable to locate a suitable wireless channel to operate on. Note that a change of state may generate an SNMP trap and/or SMTP email alert.

SNTP Synchronization failed

This warning indicates that SNTP has been enabled but that the unit is unable to synchronize with the specified SNTP server. Section Setting the real-time clock on page 6-84 explains how to configure SNTP. Note that a change of state may generate an SNMP trap and/or SMTP email alert.

Wireless Link Disabled Warning

This warning is displayed if the Wireless link has been administratively disabled via the SNMP Interface. The Wireless Interface MIB-II ifAdminStatus attribute has been set to DOWN. To enable the Ethernet interface, set the ifAdminStatus attribute to UP. Note that a change of state may generate an SNMP trap and/or SMTP email alert.

Ethernet Link Disabled Warning

This warning is displayed if the Ethernet link has been administratively disabled via the SNMP Interface. The Ethernet Interface MIB-II ifAdminStatus attribute has been set to DOWN. To enable the Ethernet interface, set the ifAdminStatus attribute to UP. Note that a change of state may generate an SNMP trap and/or SMTP email alert.

Ethernet Link Status

Current status of the Ethernet link. If there are any problems with the Ethernet interface, this alarm will be asserted. This alarm will most likely be seen if the unit has no Ethernet cable plugged into its Ethernet socket. Note that a change of state may generate an SNMP trap and/or SMTP email alert.

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Fiber Link Status

If the fiber link is not OK, there are two possible causes: Either the fiber link has been installed but disabled (because the license key does not include fiber support), or the link could not be established even though an optical carrier was detected (due perhaps to a broken TX fiber, or the link is disabled at the fiber link partner). Note that a change of status may generate an SNMP trap and/or SMTP email alert.

Telecoms Channel A/B Status

Indicates an alarm condition on a telecoms channel(Table 7-3).

Table 7-3 Telecoms channel alarm conditions

Alarm Condition	Meaning
No Signal (Local)	There is no telecoms signal present at the connection to the ODU at the local end.
No Signal (Remote)	There is an absence of telecoms data across the wireless link.
No Signal (Local and Remote)	The above two alarm conditions occur concurrently.
Remote Timing	There is insufficient wireless capacity available to carry telecoms data. Under these conditions telecoms timing information is still sent to keep the telecoms clocks synchronized.
No Signal (Local) and Remote Timing	Indicates both no local signal and remote timing.

In remote timing mode the ODU will transmit an Alarm Indication Signal (AIS), consisting of all-ones, from the associated telecoms interface. A change of state may generate an SNMP trap and/or SMTP email alert.

See Configuring telecoms circuits on page 6-68 for a description of the Telecoms Interface.

Telecoms Channel A/B Loopback

The loopback status of telecoms channel A and B. These are intended for installation testing and should be set to 'None' for normal operation. The wire connections to a unit can be tested by applying a 'Copper' loopback to the local unit. The wireless connection to the remote unit can be tested by applying a 'Wireless' loopback to the remote unit with no loopback on the local unit.

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A change of state may generate an SNMP trap and/or SMTP email alert. The loopback can be disabled from the telecoms configuration sub menu (see Configuring telecoms circuits on page 6-68). See Configuring telecoms circuits on page 6-68 for a description of the Telecoms Interface.

TDD Synchronization Alarm

Indicates the current status of the TDD Synchronization (OK, Timing System Failure, Not Synchronized). Note that a change of state may generate an SNMP trap and/or SMTP email alert.

Link Mode Optimization Mismatch

The Master and Slave ODUs are configured to use different link mode optimization methods (one is set to IP and the other TDM).

Fips Operational Mode Alarm

The FIPS operational mode alarm indicates that the unit is FIPS 140-2 capable, but has not been configured correctly for FIPS 140-2 operation. The FIPS operational mode alarm values are defined in Table 7-4.

Table 7-4 FIPS operational mode alarm values

Value	Meaning
FIPS mode is not configured	The Security Wizard has not been completed.
FIPS mode is configured, but not active	The Security Wizard has been completed, but the HTTP and Telnet management interfaces have not been disabled.

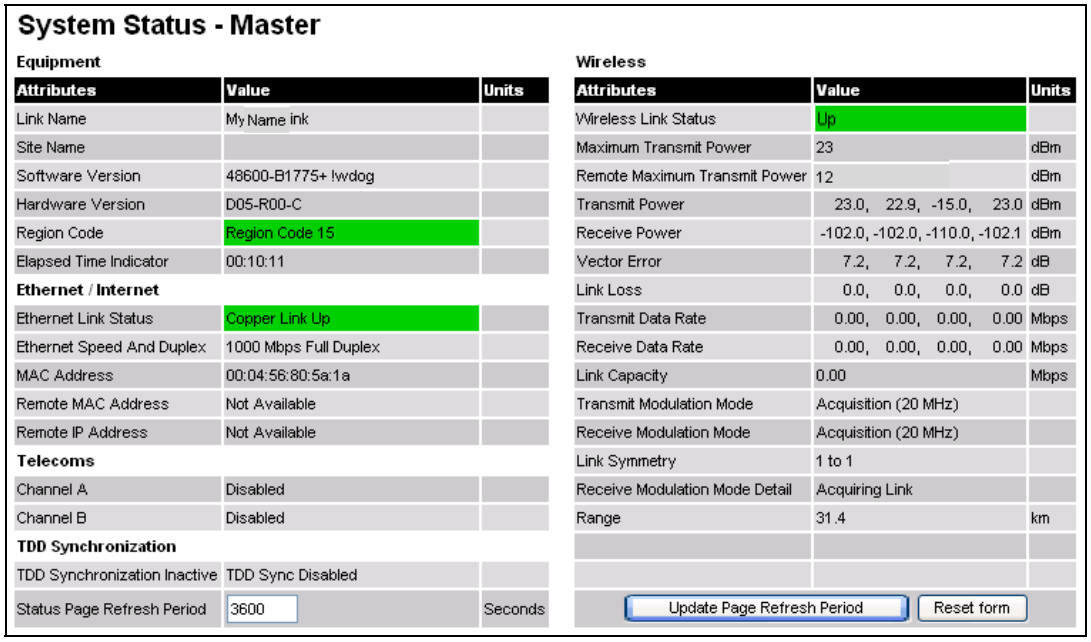
Viewing the system status

To display the System Status page, select menu option **Status**.

The System Status page (Figure 7-5) gives the user a detailed view of the operation of the PTP 600 Series from both the wireless and network perspectives.

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Figure 7-5 System Status page



System Status - Master

Equipment

Attributes	Value	Units
Link Name	My Name ink	
Site Name		
Software Version	48600-B1775+ !wdog	
Hardware Version	D05-R00-C	
Region Code	Region Code 15	
Elapsed Time Indicator	00:10:11	
Ethernet / Internet		
Ethernet Link Status	Copper Link Up	
Ethernet Speed And Duplex	1000 Mbps Full Duplex	
MAC Address	00:04:56:80:5a:1a	
Remote MAC Address	Not Available	
Remote IP Address	Not Available	
Telecoms		
Channel A	Disabled	
Channel B	Disabled	
TDD Synchronization		
TDD Synchronization Inactive	TDD Sync Disabled	
Status Page Refresh Period	3600	Seconds

Wireless

Attributes	Value	Units
Wireless Link Status	Up	
Maximum Transmit Power	23	dBm
Remote Maximum Transmit Power	12	dBm
Transmit Power	23.0, 22.9, -15.0, 23.0	dBm
Receive Power	-102.0, -102.0, -110.0, -102.1	dBm
Vector Error	7.2, 7.2, 7.2, 7.2	dB
Link Loss	0.0, 0.0, 0.0, 0.0	dB
Transmit Data Rate	0.00, 0.00, 0.00, 0.00	Mbps
Receive Data Rate	0.00, 0.00, 0.00, 0.00	Mbps
Link Capacity	0.00	Mbps
Transmit Modulation Mode	Acquisition (20 MHz)	
Receive Modulation Mode	Acquisition (20 MHz)	
Link Symmetry	1 to 1	
Receive Modulation Mode Detail	Acquiring Link	
Range	31.4	km

Update Page Refresh Period | Reset form

The page is subdivided into five categories:

- **Equipment**: This contains the unit's inventory and identification information.
- **Wireless**: This presents the key wireless metrics, which are displayed as a series of measurements.
- **Ethernet/Internet**: This describes the unit's network identity and connectivity.
- **Telecoms**: This describes the unit's E1/T1 telecoms interface parameters.
- **TDD Synchronization**: This shows the status of TDD synchronization.

The status page can be configured to refresh itself at an operator defined rate (if the user is logged in as system administrator). The refresh period defaults to 3600 seconds and can easily be changed to refresh at any period between 2 seconds and 3600 seconds. Pressing the **Update Page Refresh Period** button causes a new page refresh period to be adopted by the system. The page refresh mechanism uses a HTML Meta refresh command. Therefore the refresh is always initiated by the local browser and not by the PTP 600 Series at this interval.

The two PTP 600 Series units are arranged in a master and slave relationship. The roles of the units in this relationship are displayed in the page title. The master unit will always have the title '- Master', and the slave will always have '- Slave' appended to the 'Systems Status' page title.

The status page attributes are defined in Table 7-5..

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Table 7-5 System Status attributes

Attribute	Meaning
Link Name	The link name is allocated by the system administrator and is used to identify the equipment on the network. The link name attribute is limited to a maximum size of 63 ASCII characters.
Site Name	The site name is allocated by the system administrator and can be used as a generic scratch pad to describe the location of the equipment or any other equipment related notes. The site name attribute is limited to a maximum size of 63 ASCII characters.
Software Version	The attribute describes the version of software installed on the equipment. The format of the attributes is *FFSSS*-XX-*YY* where *FF* is the frequency variant (2.5, 4.5, 5.4, 5.8 or 5.9 GHz), *SSS* is the System Release, *XX* is the major release version and *YY* is the minor release version.
Hardware Version	The hardware version attribute contains all the combined hardware version information. The attribute is formatted as D*XX*-R*YY*-*Z* where D*XX* contain the version of the digital card, R*YY* contains the version of the RF (radio frequency) card and *Z* describes the antenna type which can be I (integrated) or C (connectorized).
Region Code	The region code is used by the system to constrain the wireless to operate within regulatory regime of the particular country. The region code is encoded in the product license key. If the operator wishes to change region code, a new license key must be obtained from Motorola or the local point-to-point distributor or system integrator.
Elapsed Time Indicator	The elapsed time indicator attribute presents the total time in years, days, hours, minutes and seconds since the last system restart. The system can restart for several reasons, for example commanded reboot from the system reboot web page, or a power cycle of the equipment.
Ethernet Link Status	This indicates the current status of the Ethernet link. A state of ‘Up’ with a green background indicates that an Ethernet link is established. A state of ‘Down’ with a red background indicates that the Ethernet link is not established.

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Attribute	Meaning
Ethernet Speed and Duplex	The negotiated speed and duplex setting of the Ethernet interface. The speed setting is specified in Mbps. Full Duplex data transmission means that data can be transmitted in both directions on a signal carrier at the same time. For example, on a local area network with a technology that has full duplex transmission; one workstation can be sending data on the line while another workstation is receiving data. Half Duplex data transmission means that data can be transmitted in both directions on a signal carrier, but not at the same time. For example, on a local area network using a technology that has half duplex transmission, one workstation can send data on the line and then immediately receive data on the line from the same direction in which data was just transmitted.
Remote IP Address	Hyperlink to the other side of the Link. The IP address of the peer link is displayed if the Link is UP, otherwise 'unavailable' is displayed.

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Attribute	Meaning
Telecoms Channel A and B	Indicate the current status of the telecoms channels. Channels which are disabled during installation are marked as such. Correctly operating channels display "Up" on a green background, but alarm conditions (described in Home page alarm display on page 7-7) have a red background. The Telecoms Latency value, displayed in microseconds, is determined when the wireless link starts and will remain the same for a given wireless configuration. Section Telecoms circuits on page 1-41 describes methods for reducing telecoms latency on links which support high data rate modulation modes. Under normal circumstances the unit will freely transition between modulation modes to suit the wireless conditions. The "Single Payload Lock" indicates that the ODU will prevent transitions from Single Payload modes to the higher Dual Payload modes in order to avoid loss of telecoms data. This field appears where such a transition would pass through modes which cannot carry telecoms data. This may be because, in order to control latency, the lowest modulation mode has been set to a higher Single Payload mode. In the absence of the Single Payload Lock the wireless will transition to the faster Dual Payload modes as soon as the conditions are appropriate. With the lock enabled, the wireless will dwell in slower Single Payload modes whenever there are operational telecoms links (operational links are shown as "Up" in the telecoms channel field described above). When the lock is actively preventing transitions, the value displayed changes from "Enabled" to "Applied".
TDD Synchronization	Displays the TDD Synchronization status for the link. For more information, refer to TDD synchronization status on page 7-19.
Refresh Page Period	The Status page refreshes automatically according to the setting entered here (in seconds). This attribute is only displayed when the user is logged on as System Administrator.

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Attribute	Meaning
Wireless Link Status	As the attribute name suggests it displays the current status of the wireless link. A state of 'Up' on a green background indicates that a point-to-point link is established. A state of 'Down' on a red background indicates that the wireless link is not established.
Maximum Transmit Power	The maximum transmit power that the local wireless unit is permitted to use to sustain a link.
Remote Maximum Transmit Power	The maximum transmit power that the remote wireless unit is permitted to use to sustain a link.
Transmit Power	Transmit power histogram is expressed in dBm and presented as: max, mean, min, and latest. The max, min and latest are true instantaneous measurements; the mean is the mean of a set of one second means. See Histogram data on page 7-21.
Receive Power	Receive power histogram is expressed in dBm and presented as: max, mean, min, and latest. The max, min and latest are true instantaneous measurements; the mean is the mean of a set of one second means. See Histogram data on page 7-21.
Vector Error	The vector error measurement compares the received signal's In phase / Quadrature (IQ) modulation characteristics to an ideal signal to determine the composite error vector magnitude. The results are stored in an histogram and expressed in dB and presented as: max, mean, min and latest. The max, min and latest are true instantaneous measurements; the mean is the mean of a set of one second means. The expected range for Vector Error would be approximately -2dB (NLOS link operating at sensitivity limit on BPSK 0.67) to –33dB (short LOS link running 256 QAM 0.83). See Histogram data on page 7-21.

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Attribute	Meaning
Link Loss	The link loss is the total attenuation of the wireless signal between the two point-to-point units. See Histogram data on page 7-21. The link loss calculation presented below: $P_{ll} = P_{T_x} - P_{R_x} + g_{T_x} + g_{R_x}$ Where: P_{ll} = Link Loss (dB) P_{T_x} = Transmit power of the remote wireless unit (dBm) P_{R_x} = Received signal power at the local unit (dBm) g_{T_x}, g_{R_x} = Antenna gain at the remote and local units respectively (dBi). The antenna gain of the PTP 600 Series (23.5 dBi) is used unless one or both of the units is a Connectorized version. For connectorized ODUs, the link loss calculation is modified to allow for the increased antenna gains at each end of the link.
Transmit Data Rate	The data rate in the transmit direction, expressed in Mbps and presented as: max, mean, min, and latest in an histogram format. The max, min and latest are true instantaneous measurements; the mean is the mean of a set of one second means. Expected data rates can be found in Data rate calculations on page 4-114.
Receive Data Rate	The data rate in the receive direction, expressed in Mbps and presented as: max, mean, min, and latest in an histogram format. The max, min and latest are true instantaneous measurements; the mean is the mean of a set of one second means. Expected data rates can be found in Data rate calculations on page 4-114.
Link Capacity	The maximum aggregate data rate capacity available for user traffic, assuming the units have been connected using Gigabit Ethernet. The link capacity is variable and depends on the prevailing wireless conditions as well as the distance (range) between the two wireless units.

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Attribute	Meaning
Transmit Modulation Mode	The modulation mode currently being used on the transmit channel. A list of all the modulation modes can be found in Data rate calculations on page 4-114, where data rate calculations plots are given for each available modulation mode.
Receive Modulation Mode	The modulation mode currently being used on the receive channel. A list of all the modulation modes can be found in Data rate calculations on page 4-114, where data rate calculations plots are given for each available modulation mode.
Link Symmetry	A ratio that expresses the division between transmit and receive time in the TDD frame. The first number in the ratio represents the time allowed for the transmit direction and the second number represents the time allowed for the receive direction. **NOTE** Link Symmetry is configured at the master ODU only. The appropriate matching Link Symmetry is set at the slave ODU automatically. For example, if Link Symmetry is configured as '2 to 1' at the master ODU, then the slave ODU will be set automatically as '1 to 2'. In this example, the master-slave direction has double the capacity of the slave-master direction.
Receive Modulation Mode Detail	This supplies the user with information regarding the receive modulation mode in use. Possible values are: 'Running at maximum receive mode' 'Running at user-configured Max Modulation Mode' 'Restricted due to byte errors on the wireless link or local Ethernet Tx Fifo Drops' 'Restricted because a DFS channel change is in progress' 'Restricted due to telecoms acquisition mode' 'Restricted due to the low Ethernet link speed' 'Limited by the wireless conditions'

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Attribute	Meaning
Range	The range between the PTP 600 Series ODUs. This is displayed in km by default, but can be changed to miles by updating the 'Distance Units' attribute to imperial, as described in Protecting access to the summary and status pages on page 6-45.

TDD synchronization status

The Status Page displays the TDD Synchronization status for the link.

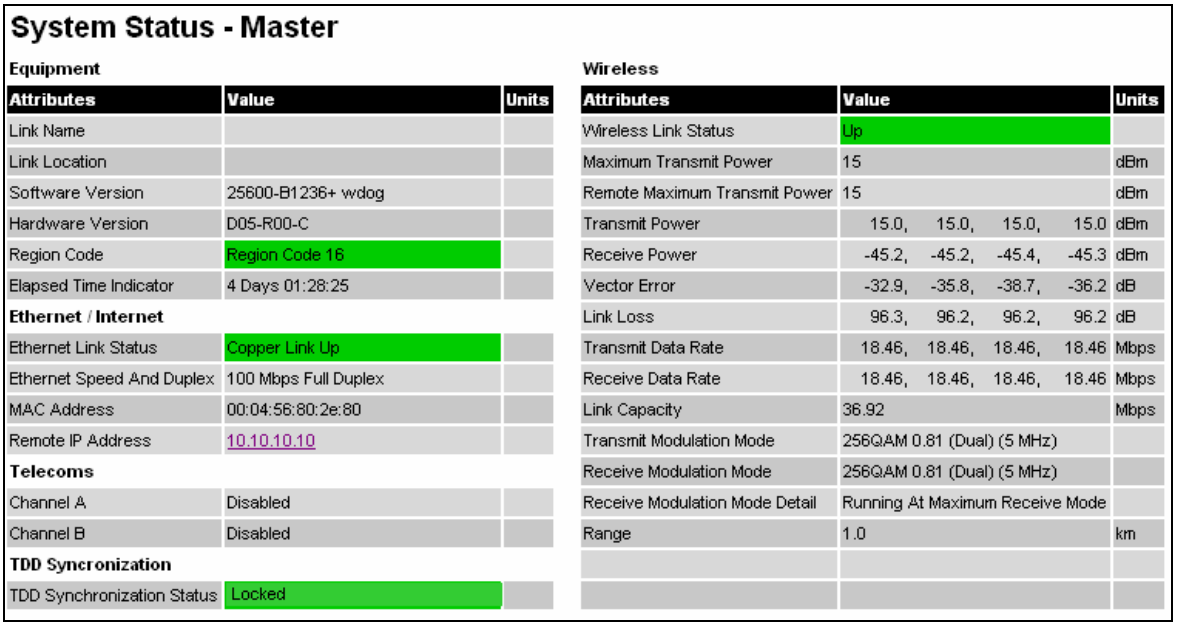
If TDD Synchronization is not enabled, the Attribute is set to 'TDD Synchronization Inactive' and the Value is set to 'Timing System Not Connected'.

If TDD Synchronization is enabled and the installation is rebooted, the Attribute is set to 'TDD Synchronization Status' and the Value is set to one of the following:

- 'Locked' (Figure 7-6)
- 'Holdover'
- 'Holdover (Not Connected)'
- 'Acquiring Lock'
- 'No Timing Reference'
- 'Timing System Not Connected' (Figure 7-7)
- 'Initializing'

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Figure 7-6 Status page - TDD enabled and synchronized



System Status - Master

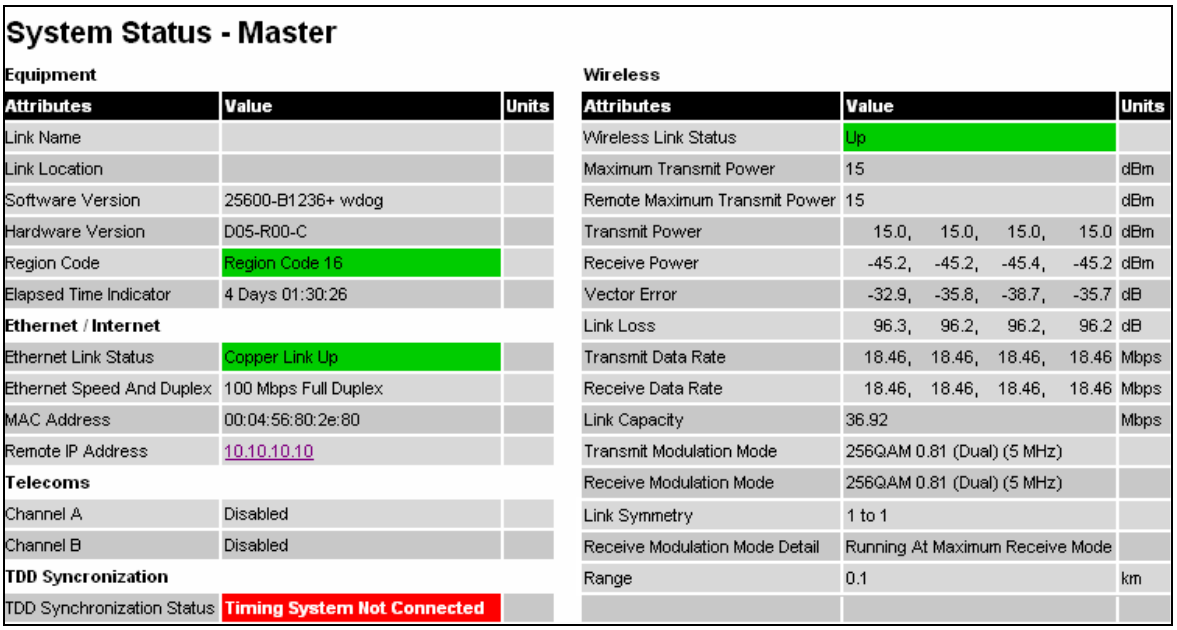
Equipment

Attributes	Value	Units
Link Name		
Link Location		
Software Version	25600-B1236+ wdog	
Hardware Version	D05-R00-C	
Region Code	Region Code 16	
Elapsed Time Indicator	4 Days 01:28:25	
Ethernet / Internet		
Ethernet Link Status	Copper Link Up	
Ethernet Speed And Duplex	100 Mbps Full Duplex	
MAC Address	00:04:56:80:2e:80	
Remote IP Address	10.10.10.10	
Telecoms		
Channel A	Disabled	
Channel B	Disabled	
TDD Syncronization		
TDD Synchronization Status	Locked	

Wireless

Attributes	Value	Units
Wireless Link Status	Up	
Maximum Transmit Power	15	dBm
Remote Maximum Transmit Power	15	dBm
Transmit Power	15.0, 15.0, 15.0, 15.0	dBm
Receive Power	-45.2, -45.2, -45.4, -45.3	dBm
Vector Error	-32.9, -35.8, -38.7, -36.2	dB
Link Loss	96.3, 96.2, 96.2, 96.2	dB
Transmit Data Rate	18.46, 18.46, 18.46, 18.46	Mbps
Receive Data Rate	18.46, 18.46, 18.46, 18.46	Mbps
Link Capacity	36.92	Mbps
Transmit Modulation Mode	256QAM 0.81 (Dual) (5 MHz)	
Receive Modulation Mode	256QAM 0.81 (Dual) (5 MHz)	
Receive Modulation Mode Detail	Running At Maximum Receive Mode	
Range	1.0	km

Figure 7-7 Status page - TDD enabled and not synchronized



System Status - Master

Equipment

Attributes	Value	Units
Link Name		
Link Location		
Software Version	25600-B1236+ wdog	
Hardware Version	D05-R00-C	
Region Code	Region Code 16	
Elapsed Time Indicator	4 Days 01:30:26	
Ethernet / Internet		
Ethernet Link Status	Copper Link Up	
Ethernet Speed And Duplex	100 Mbps Full Duplex	
MAC Address	00:04:56:80:2e:80	
Remote IP Address	10.10.10.10	
Telecoms		
Channel A	Disabled	
Channel B	Disabled	
TDD Syncronization		
TDD Synchronization Status	Timing System Not Connected	

Wireless

Attributes	Value	Units
Wireless Link Status	Up	
Maximum Transmit Power	15	dBm
Remote Maximum Transmit Power	15	dBm
Transmit Power	15.0, 15.0, 15.0, 15.0	dBm
Receive Power	-45.2, -45.2, -45.4, -45.2	dBm
Vector Error	-32.9, -35.8, -38.7, -35.7	dB
Link Loss	96.3, 96.2, 96.2, 96.2	dB
Transmit Data Rate	18.46, 18.46, 18.46, 18.46	Mbps
Receive Data Rate	18.46, 18.46, 18.46, 18.46	Mbps
Link Capacity	36.92	Mbps
Transmit Modulation Mode	256QAM 0.81 (Dual) (5 MHz)	
Receive Modulation Mode	256QAM 0.81 (Dual) (5 MHz)	
Link Symmetry	1 to 1	
Receive Modulation Mode Detail	Running At Maximum Receive Mode	
Range	0.1	km

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Histogram data

The histogram is calculated over a one hour period. If the equipment has been running for less than one hour, then the histogram is calculated over the current elapsed time. The data used to compute the histogram statistics can be downloaded in an ASCII comma separated value (CSV) format via the diagnostics CSV Download page, see Downloading diagnostic data on page 7-54.

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Managing spectrum

This section describes how to configure the spectrum management feature of the PTP 600 and how to interpret spectrum management graphical plots.

This section contains the following procedures:

- Configuring spectrum usage at the master on page 7-22
- Viewing spectrum usage at the slave on page 7-25
- Interpreting the spectrum management plots on page 7-27
- Viewing the active channel history on page 7-36
- Viewing historic spectrum management metrics on page 7-37

Configuring spectrum usage at the master

All spectrum management configuration changes are applied at the master ODU only. These changes are then sent from the master to the slave, so that both master and slave keep identical copies of spectrum management configuration. It is therefore possible to swap master and slave roles on an active PTP 600 link without modifying Spectrum Management configuration.

NOTE

Before attempting to improve the performance of the spectrum management algorithm by changing the default configuration, consulting the Motorola Point-to-Point distributor or one of the system field support engineers.

The default channelization can be modified by varying the lower center frequency attribute in the installation wizard, as described in Step 2: Wireless configuration on page 6-54.

To configure spectrum usage at the master, proceed as follows:

Procedure 7-1 Configure spectrum usage at the master

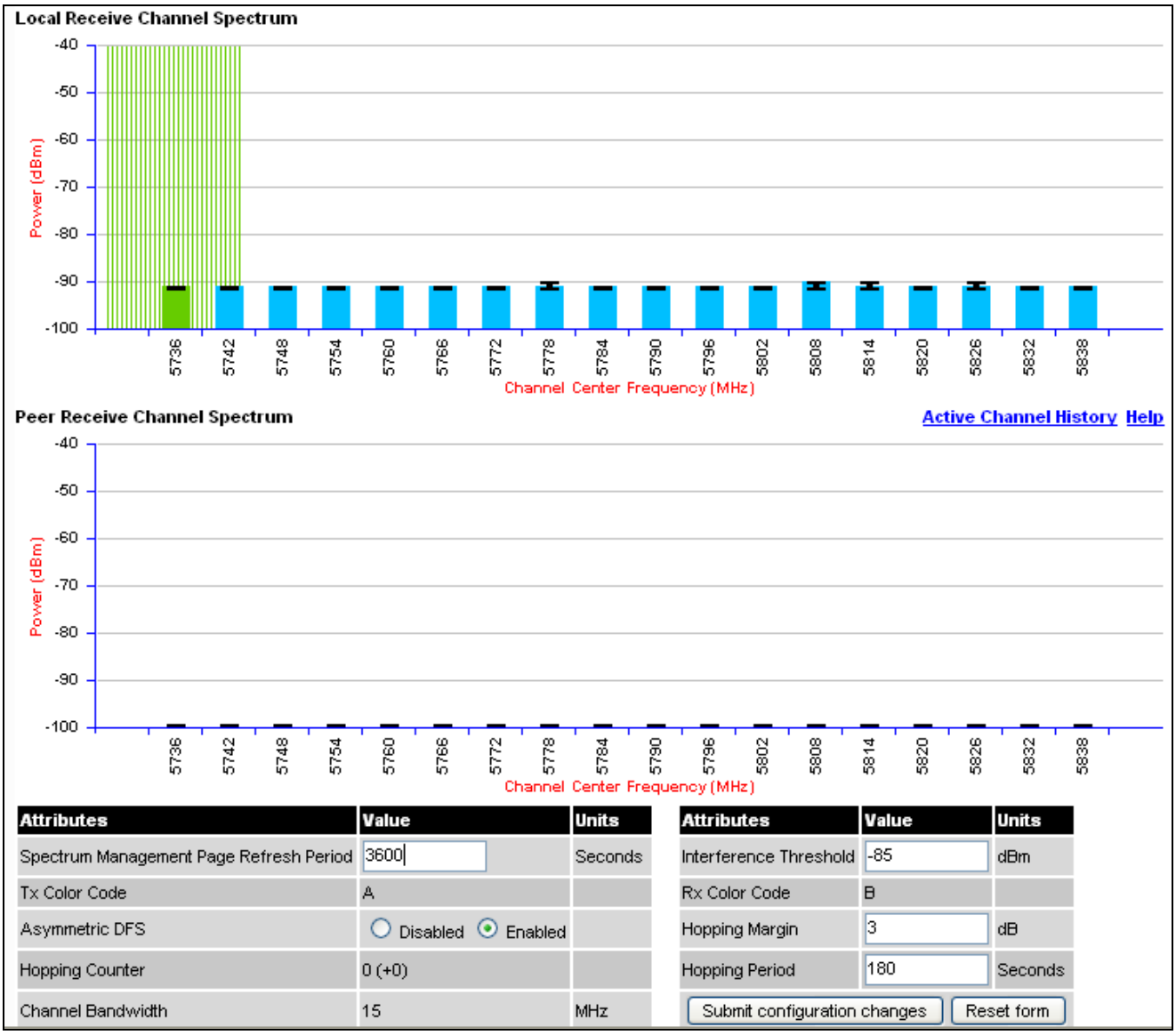
1	Log into the master ODU for the link.
2	Select menu option **System, Spectrum Management**. The Spectrum Management page is displayed (Figure 7-8).
3	Review and update the configuration attributes (Table 7-6).
4	Select **Submit configuration changes**.

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NOTE

Figure 7-8 illustrates 15 MHz operation; other channel bandwidths are similar. The width of the vertical green bar represents the channel width.

Figure 7-8 Spectrum Management as seen from the Master



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Table 7-6 Spectrum Management attributes

Attribute	Meaning
Page Refresh Period	The page refreshes automatically according to the setting entered here (in seconds).
Hopping Margin	Spectrum Management uses this margin when making a channel hop decision. If the interference level of the target channel is lower than that of the active channel by at least the Hopping Margin, the link will hop to the target channel. The default setting is 3 dB in non-radar regions, or 10 dB in radar regions.
Asymmetric DFS	Only displayed in non-radar regions when i-DFS is enabled. The default configuration of symmetric operation constrains the link to operate symmetrically, using the same transmit and receive channels. When in symmetric mode the slave unit will always follow the master. If the master moves to a new channel the slave will hop to the same channel. When the Point-to-Point link is configured as an asymmetric link both the master and slave are free to select the best channel from their own set of local interference metrics.
Spectrum Management Control	Only displayed in radar regions. The options are ‘DFS’ and ‘DFS with i-DFS’.
Hopping Period (not configurable)	The Spectrum Management algorithm evaluates the metrics every ‘Hopping Period’ seconds (180 seconds by default) looking for a channel with lower levels of interference. If a better channel is located, Spectrum Management performs an automated channel hop. If SNMP or SMTP alerts are enabled an SNMP TRAP or an email alert is sent warning the system administrator of the channel change.
Hopping Counter	This is used to record the number of channel hops. The number in the (+) brackets indicates the number of channel changes since the last screen refresh.

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Attribute	Meaning
Interference Threshold	Spectrum Management uses the interference threshold to perform instantaneous channel hops. If the measured interference on a channel exceeds the specified threshold, then i-DFS will instruct the wireless to immediately move to a better channel. If a better channel cannot be found the PTP 600 Series will continue to use the current active channel. (Default –85 dBm).
Channel Bandwidth (not configurable)	This shows the value of the variable channel bandwidth selected.

Barring a channel

Channels can only be barred or unbarred from the master Spectrum Management web page.

To bar or unbar a channel, click on the appropriate channel on the Local or Peer channel spectrum plots on the master Spectrum Management web page (Figure 7-8). When the confirmation dialog is displayed, select **OK**.

The channel bar will take effect immediately and is not related to the measurement quantization period.

Viewing spectrum usage at the slave

To view spectrum usage at the slave, proceed as follows:

Procedure 7-2 View spectrum usage at the slave

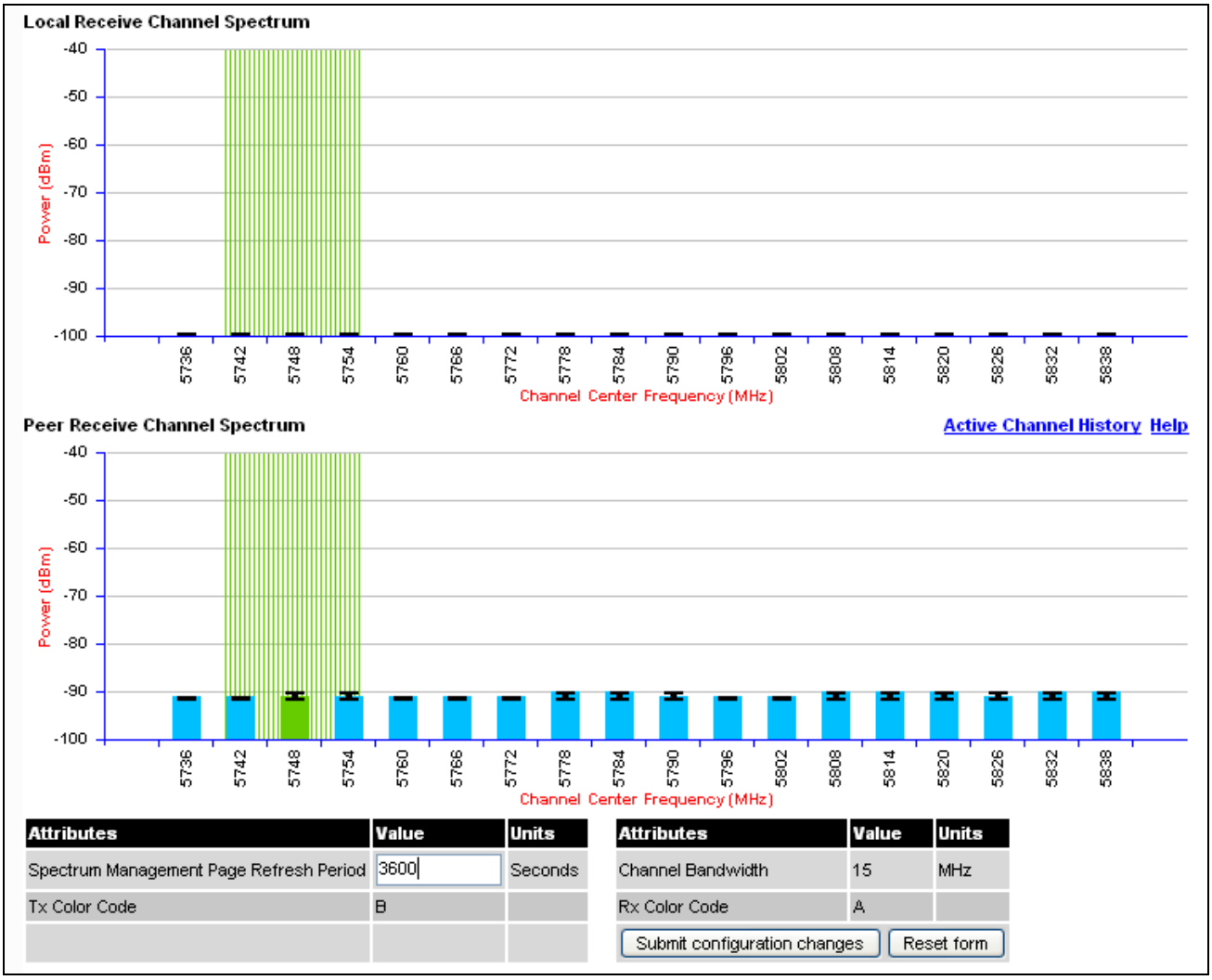
1	Log into the slave ODU for the link.
2	Select menu option **System, Spectrum Management**. The Spectrum Management page is displayed (Figure 7-9).
3	If necessary, update the Page Refresh Period and select **Submit configuration changes**.

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NOTE

Figure 7-9 illustrates 15 MHz operation; other channel bandwidths are similar. The width of the vertical green bar represents the channel width.

Figure 7-9 Spectrum Management as seen from the Slave



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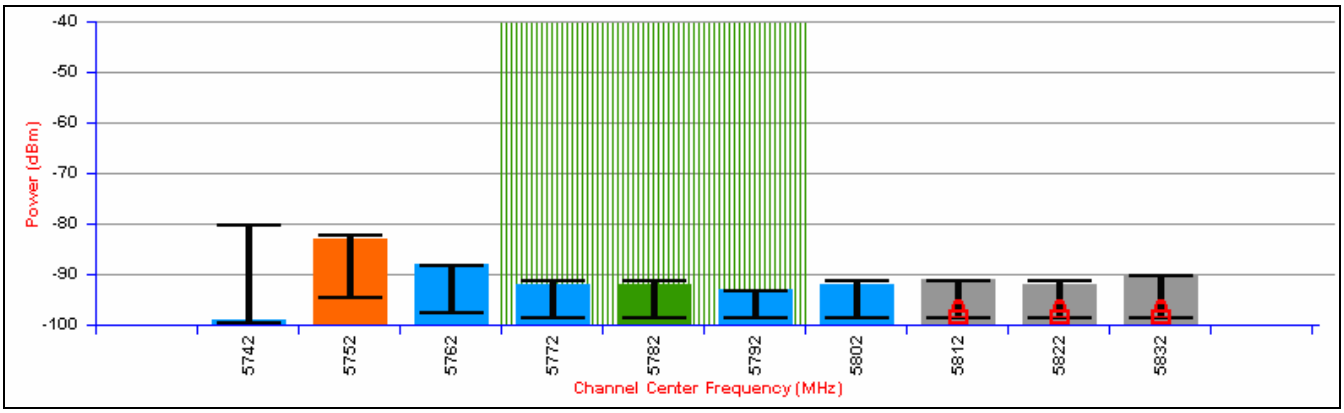
Interpreting the spectrum management plots

The Spectrum Management pages at the master and slave (Figure 7-8 and Figure 7-9) display two graphical plots:

- Local Receive Channel Spectrum
- Peer Receive Channel Spectrum

A more detailed example of one of these plots is shown in Figure 7-10.

Figure 7-10 Example spectrum management plot



NOTE

For more information, select the **Help** hyperlink from the Spectrum Management page.

X axis and Y axis

The X-axis shows a stylized view of the selectable wireless channels. Adjacent channels on the display have a 10 MHz overlap. Channels are displayed separately for clarity. The axis is labeled using the channel center frequencies in MHz.

The Y-axis shows the interference power levels from –100 to –40 dBm.

Channel states

The active channel (channel 5 in Figure 7-10) is always marked using hatched green and white lines. The width of the hatching is directly proportional the channel bandwidth spectral occupancy of the channel.

The individual channel metrics are displayed using a colored bar and an 'I' bar. The colored bar represents the channel state (Table 7-7).

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Table 7-7 Channel states represented in the spectrum management plot

State	Meaning
Active	The channel is currently in use, hosting the Point-to-Point wireless link.
Interference	The channel has interference above the interference threshold .
Available	The channel has an interference level below the interference threshold and is considered by the Spectrum Management algorithm suitable for hosting the Point-to-Point link.
Barred	The system administrator has barred this channel from use. For improved visibility, an additional red ‘lock’ symbol is used to indicate that a channel is barred.

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Key metrics

The 'I' bar and top of the coloured bar represent three key metrics (Table 7-8). The vertical part of the 'I' bar represents the statistical spread between the peak and the mean of the statistical distribution.

Table 7-8 Key metrics represented in the spectrum management plot

Metric	Description	How represented
Peak of Means	The largest mean interference measurement encountered during the quantization period. The peak of means is useful for detecting slightly longer duration spikes in the interference environment.	Upper horizontal bar.
Mean of Means	The arithmetic mean of the measured means during a quantization period. The mean of means is a coarse measure of signal interference and gives an indication of the average interference level measured during the quantization period. The metric is not very good at predicting intermittent interference and is included to show the spread between the Mean of Means, the 99.9% Percentile and the Peak of Means.	Lower horizontal bar.
99.9% Percentile of the Means	The value of mean interference measurement which 99.9% of all mean measurements fall below, during the quantization period. The 99.9% percentile metric is useful for detecting short duration repetitive interference that by its very nature has a minimal effect of the mean of means.	Top of the colored bar.

NOTE

The arithmetic mean is the true power mean and not the mean of the values expressed in dBm.

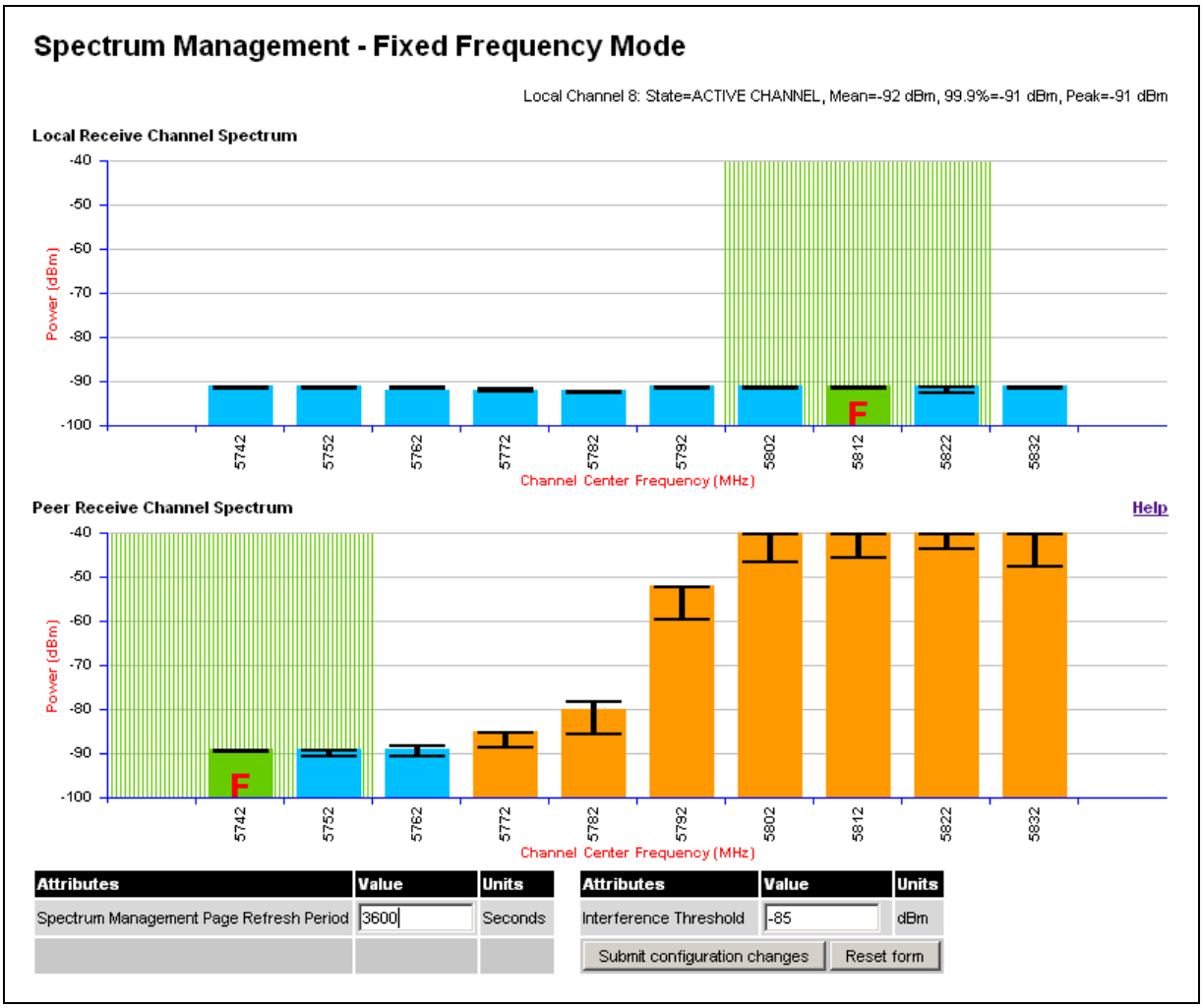
Spectrum Management uses the 99.9% Percentile as the prime interference measurement. All subsequent references to interference level refer to this percentile measurement.

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Spectrum management in fixed frequency mode

When the link is operating in fixed frequency mode, the Spectrum Management page uses two visual cues (Figure 7-11). The main page title has the ‘Fixed Frequency Mode’ suffix and the selected channels are identified by a red capital ‘F’.

Figure 7-11 Spectrum Management Fixed Frequency Mode page



Channel barring is disabled in fixed frequency mode; it is not required as dynamic channel hopping is prohibited in this mode.

The only controls available to the master are the Page Refresh Period and Interference Threshold attributes. They will have no effect on the operation of the wireless link and will only effect the generation of the channel spectrum graphics.

The active channel history menu is removed in this mode of operation, as channel hopping is prohibited.

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Spectrum management in radar avoidance mode

When the link is operating in radar avoidance mode, the Spectrum Management page (Figure 7-12 and Figure 7-13) contains the following additional information:

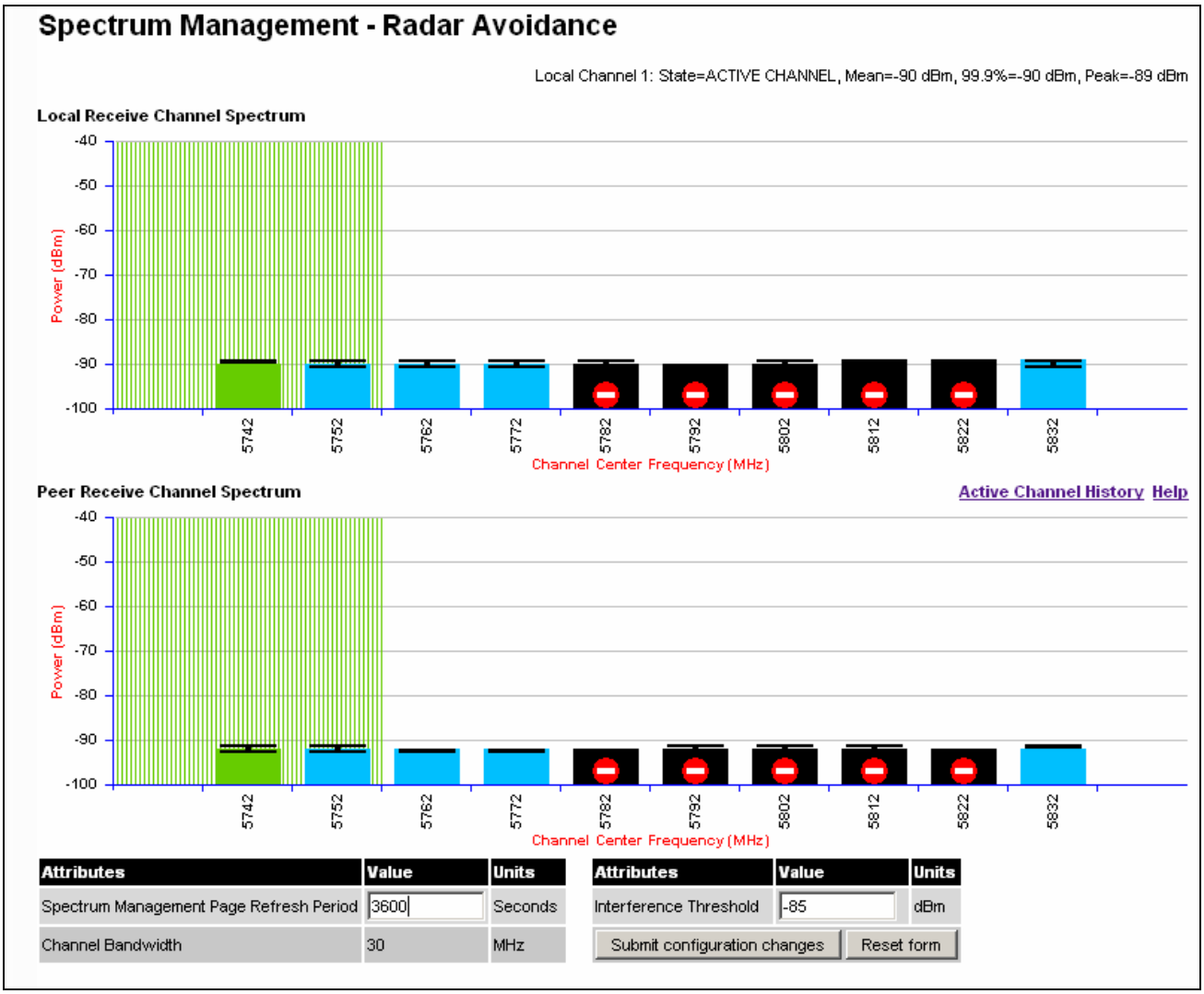
- The main page title has the ‘Radar Avoidance’ suffix.
- The only controls available to the master are the Interference Threshold attribute. This has no effect on the operation of the wireless link and will only affect the generation of the channel spectrum graphics.
- Extra color coding of the interference histogram is provided (Table 7-9).

When operating with RTTT (Road transport and Traffic Telematics) Avoidance enabled or other regulatory restrictions on channel usage, the page contains the following additional information:

- All channels marked with a ‘no entry’ symbol with their associated statistics colored black are the prohibited channels. These channels are never used to host the wireless link, but CAC measurements are still taken so that adjacent channel biases can be calculated correctly and so the user can see if other equipment is in use.

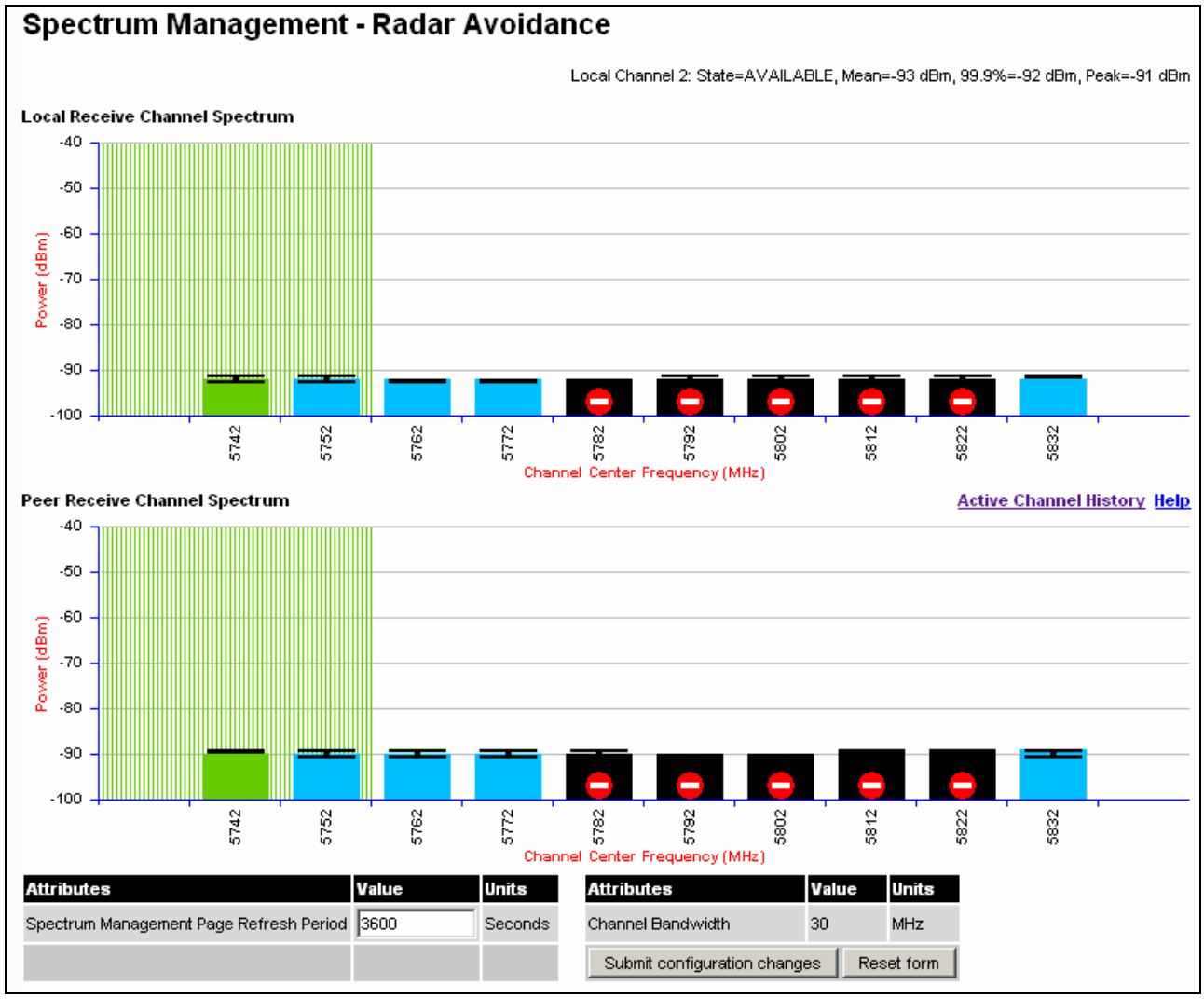
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Figure 7-12 Spectrum Management page with radar avoidance - master



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Figure 7-13 Spectrum Management page with radar avoidance - slave



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Table 7-9 Channel states represented in the spectrum management plot (radar avoidance)

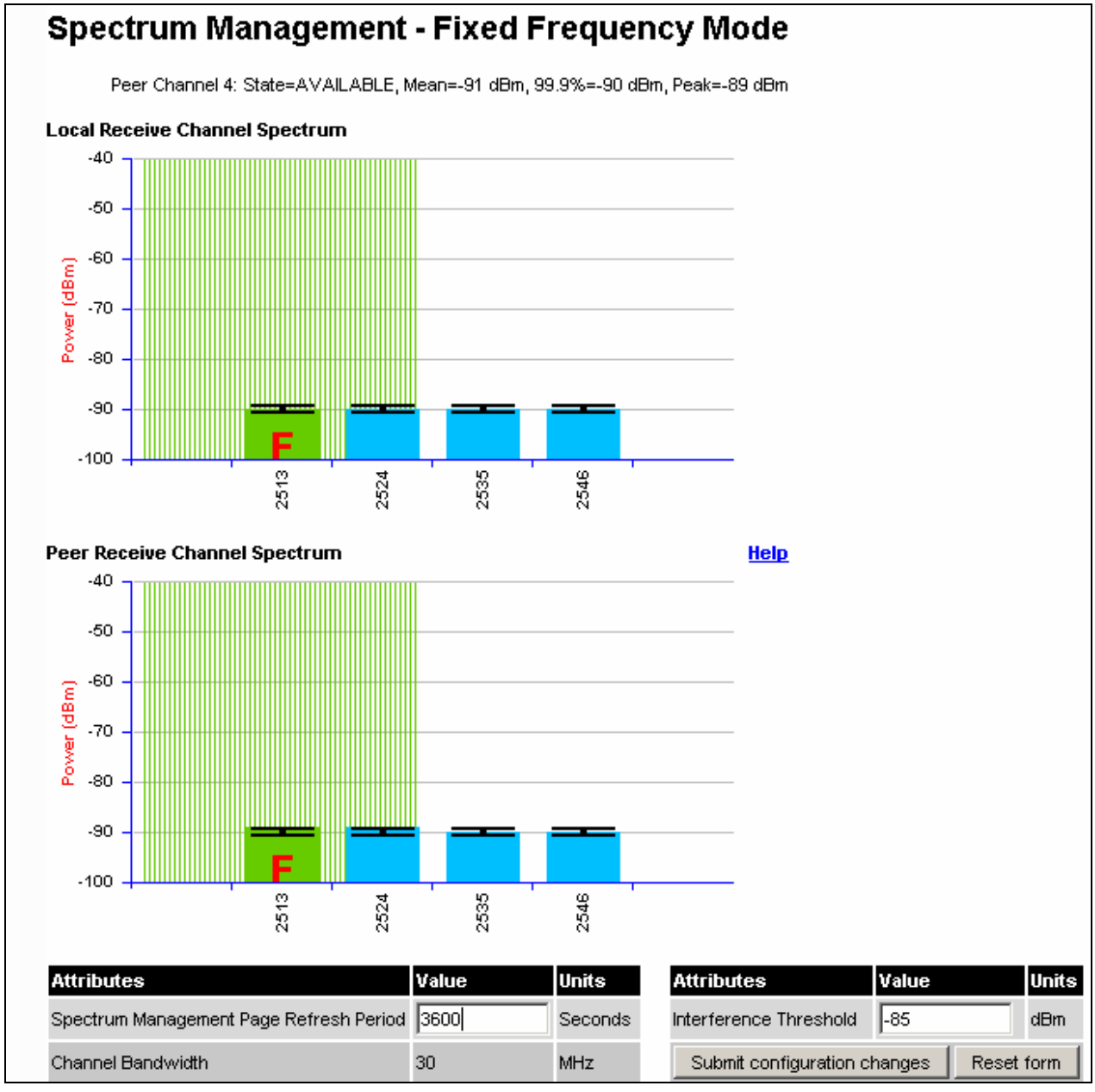
State and color	Meaning
Active	This channel is currently in use hosting the Point-to-Point wireless link.
Interference	This channel has interference above the interference threshold
Available	This channel has an interference level below the interference threshold and is considered by the Spectrum Management algorithm suitable for hosting the Point-to-Point link
Barred	The system administrator has barred this channel from use. Because the low signal levels encountered when a unit is powered up in a laboratory environment prior to installation (which makes the grey of the channel bar difficult to see). An additional red 'lock' symbol is used to indicate that a channel is barred.
Unavailable	This channel needs to be monitored for one minute and found free of radar signal before it can be used for transmitting.
Radar Detected	Impulsive Radar Interference has been detected on this channel and the channel is unavailable for 30 minutes. At the end of the 30 minute period a Channel Availability Check is required to demonstrate no radar signals remain on this channel before it can be used for the radio link.
Region Bar	This channel has been barred from use by the local region regulator

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Spectrum management for the PTP 25600 variant

The PTP 25600 frequency variant can operate in three frequency bands. Figure 7-14 shows an example of a Lower Band with a 30 MHz channel bandwidth.

Figure 7-14 PTP 25600 example of Spectrum Management page



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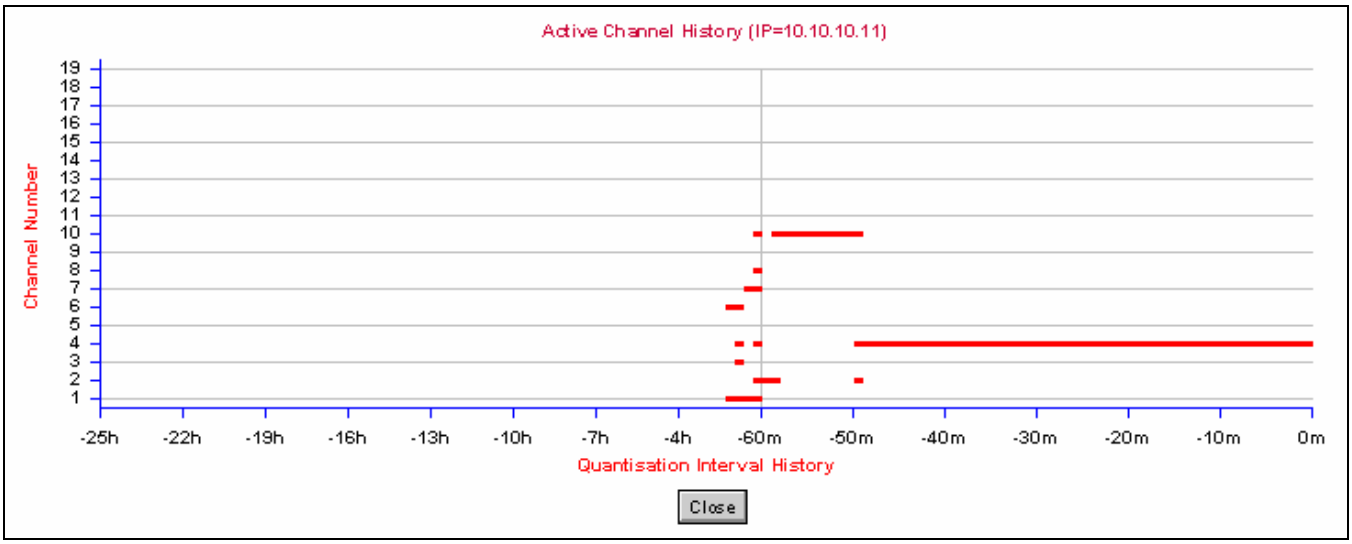
Viewing the active channel history

The active channel history is a time series display of the channels used by the PTP 600 Series over the last 25 hours.

To view the active channel history, select the **Active Channel History** hyperlink from the Spectrum Management page.

An example of the active channel history display is shown in Figure 7-15. Where there are parallel entries on the display this signifies that the wireless link occupied this channel during the measurement period. The measurement periods are one minute (from zero to sixty minutes) and twenty minutes from (60 minutes to twenty five hours).

Figure 7-15 Active channel history screen



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Viewing historic spectrum management metrics

The results of previous measurement quantization periods can be viewed from both the master and slave Spectrum Management pages.

To view these results, hold down the shift key and click the appropriate channel on the Local Receive Channel Separation plot.

The time series plot is displayed (Figure 7-16). This plot displays the results of all previous measurement quantization periods, up to a maximum of 132 periods. The coloured lines represent interference measurements (Table 7-10).

Figure 7-16 Spectrum management time series plot

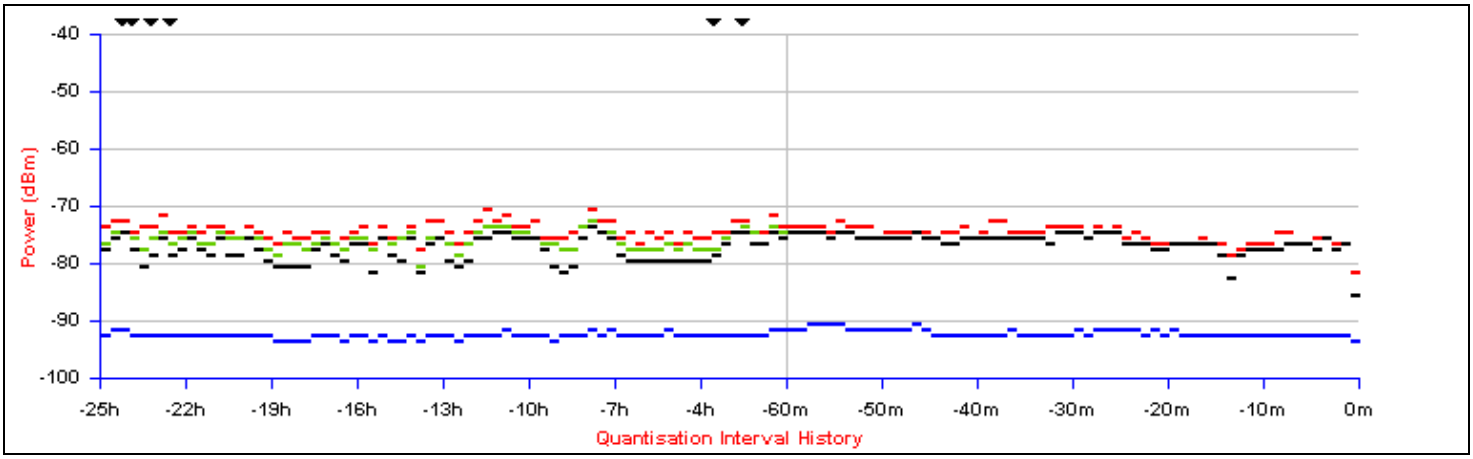


Table 7-10 Interference represented in the time series plot

Color	Meaning
GREEN	Peak of Means interference measurement
BLACK	99.9% percentile of means interference measurement
BLUE	Mean of Means interference measurement

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Remote software upgrade by TFTP

This section describes how to upgrade the PTP 600 software remotely using Trivial FTP (TFTP) triggered by SNMP.

To perform a remote software upgrade, follow this procedure:

Procedure 7-3 Remote software upgrade

1	Check that the TFTP client is enabled. Refer to Configuring HTTP, Telnet and TFTP access on page 6-110.
2	Set tFTP attributes as described in Table 7-11.
3	Monitor tFTP attributes as described in Table 7-12.
4	When the upgrade is complete, reboot the ODU to run the newly loaded software image as described in Rebooting the unit on page 8-27.

Table 7-11 Setting tFTP attributes

Attribute	Meaning
tFTPServerIPAddress	The IP address of the TFTP server from which the TFTP software upgrade file Name will be retrieved. For example, to set the TFTP server IP address for unit 10.10.10.10 to 10.10.10.1, enter this command: **`snmpset_d.exe -v 2c -c public 10.10.10.10 .iso.3.6.1.4.1.17713.1.9.5.0 a 10.10.10.1`**
tFTPServerPortNumber	This setting is optional. The port number of the TFTP server from which the TFTP software upgrade file name will be retrieved (default=69).
tFTPSoftwareUpgrade FileName	The filename of the software upgrade to be loaded from the TFTP server. For example, to set the TFTP software upgrade filename on 10.10.10.10 to "B1095.dld", enter this command: **`snmpset_d.exe -v 2c -c public 10.10.10.10 .iso.3.6.1.4.1.17713.1.9.7.0 s B1095.dld`**

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Attribute	Meaning
tFTPStartSoftware Upgrade	Write '1' to this attribute to start the TFTP software upgrade process. The attribute will be reset to 0 when the upgrade process has finished. For example, enter this command: **snmpset_d.exe -v 2c -c public 10.10.10.10 .iso.3.6.1.4.1.17713.1.9.8.0 i 1**

Table 7-12 Monitoring tFTP attributes

Attribute	Meaning
tFTPSoftwareUpgradeStatus	This is the current status of the TFTP software upgrade process. Values: idle(0) uploadinprogress(1) uploadsuccessfulprogrammingFLASH(2) upgradesuccessfulreboottorunthenewsoftwareimage(3) upgradefailed(4). For example, enter this command: **snmpget_d.exe -v 2c -c public 10.10.10.10 .iso.3.6.1.4.1.17713.1.9.9.0**
tFTPSoftwareUpgradeStatus Text	This describes the status of the TFTP software upgrade process, including any error details. For example, enter this command: **snmpget_d.exe -v 2c -c public 10.10.10.10 .iso.3.6.1.4.1.17713.1.9.10.0**
tFTPSoftwareUpgradeStatus AdditionalText	This is used if tFTPSoftwareUpgradeStatusText is full and there are more than 255 characters to report. It contains additional text describing the status of the TFTP software upgrade process, including any error details. For example, enter this command: **snmpget_d.exe -v 2c -c public 10.10.10.10 .iso.3.6.1.4.1.17713.1.9.11.0**

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Managing security

This section contains the following procedures:

- Exiting FIPS 140-2 mode on page 7-40
- Zeroizing critical security parameters on page 7-40

Other security configuration procedures are described in Task 4: Configure security on page 6-21.

Exiting FIPS 140-2 mode

To exit from the FIPS 140-2 mode, do one of the following:

- Load a PTP 600 license key that has FIPS operation disabled and reboot. Refer to Task 2: Install license keys on page 6-12.
- Load PTP 600 software that is not FIPS-validated and reboot. Refer to Task 3: Upgrade software version on page 6-16.

NOTE

The critical security parameters (CSPs) are zeroized when the unit is no longer FIPS 140-2 Capable.

Zeroizing critical security parameters

Critical security parameters (CSPs) are as follows:

- Key of keys.
- AES encryption keys for the wireless interface.
- Private key for the HTTPS/TLS interface.
- Entropy value for the HTTPS/TLS interface.
- User account passwords for the web-based interface.

To zeroize the CSPs, select option **Security, Zeroize CSPs** and then **Select Zeroize CSPs and Reboot Wireless Unit**. Confirm the reboot.

Alternatively, select the **Zeroize CSPs** option in Recovery mode.

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Managing performance

This section describes how to manage the performance of the PTP 600 link.

This section contains the following procedures:

- Checking system statistics on page 7-41
- Resetting system histograms and counters on page 7-48
- Checking detailed counters on page 7-48
- Using the diagnostics plotter on page 7-52
- Downloading diagnostic data on page 7-54

Checking system statistics

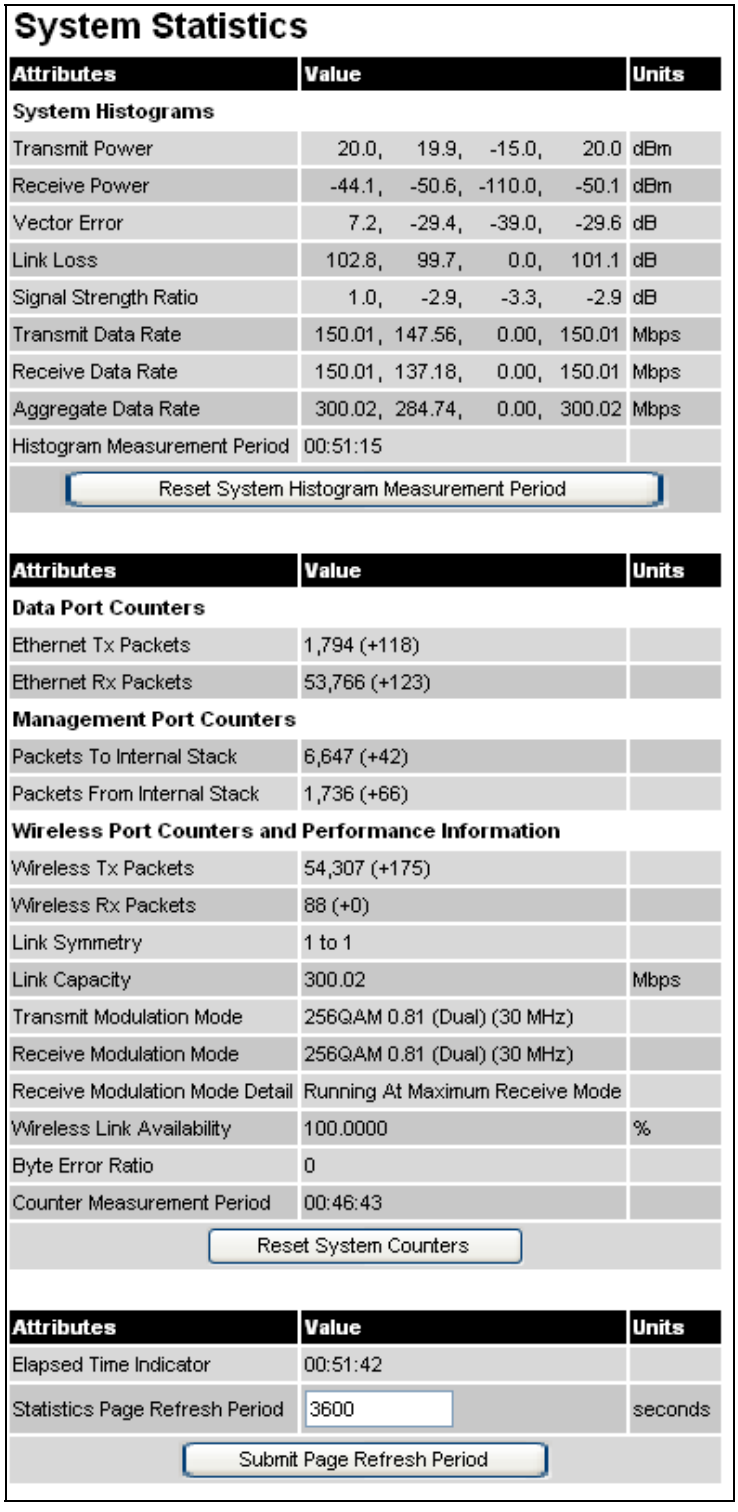
To check system statistics, select menu option **System, Statistics**. The System Statistic page is displayed (Figure 7-17).

NOTE

To enable or disable the display of commas in long integers (for example 1,234,567), select menu option **Management, Web, Web Properties** and update the Use Long Integer Comma Formatting attribute.

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Figure 7-17 System Statistics page



System Statistics

Attributes	Value	Units
System Histograms		
Transmit Power	20.0, 19.9, -15.0, 20.0	dBm
Receive Power	-44.1, -50.6, -110.0, -50.1	dBm
Vector Error	7.2, -29.4, -39.0, -29.6	dB
Link Loss	102.8, 99.7, 0.0, 101.1	dB
Signal Strength Ratio	1.0, -2.9, -3.3, -2.9	dB
Transmit Data Rate	150.01, 147.56, 0.00, 150.01	Mbps
Receive Data Rate	150.01, 137.18, 0.00, 150.01	Mbps
Aggregate Data Rate	300.02, 284.74, 0.00, 300.02	Mbps
Histogram Measurement Period	00:51:15	

Reset System Histogram Measurement Period

Attributes	Value	Units
Data Port Counters		
Ethernet Tx Packets	1,794 (+118)	
Ethernet Rx Packets	53,766 (+123)	
Management Port Counters		
Packets To Internal Stack	6,647 (+42)	
Packets From Internal Stack	1,736 (+66)	
Wireless Port Counters and Performance Information		
Wireless Tx Packets	54,307 (+175)	
Wireless Rx Packets	88 (+0)	
Link Symmetry	1 to 1	
Link Capacity	300.02	Mbps
Transmit Modulation Mode	256QAM 0.81 (Dual) (30 MHz)	
Receive Modulation Mode	256QAM 0.81 (Dual) (30 MHz)	
Receive Modulation Mode Detail	Running At Maximum Receive Mode	
Wireless Link Availability	100.0000	%
Byte Error Ratio	0	
Counter Measurement Period	00:46:43	

Reset System Counters

Attributes	Value	Units
Elapsed Time Indicator	00:51:42	
Statistics Page Refresh Period	3600	seconds

Submit Page Refresh Period

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System histograms

The System Histograms attributes (Table 7-13) are presented as an array of four elements. These elements represent the maximum, mean, minimum and latest values respectively. The maximum, mean and minimum are calculated over a running one hour period.

To reset all histograms and restart the measurement period, select **Reset System Histograms and Measurement Period**.

Table 7-13 System Histograms attributes in the System Statistics page

Attribute	Meaning
Transmit Power	The transmit power histogram, calculated over a one hour period.
Receive Power	The receive power histogram, calculated over a one hour period.
Vector Error	The vector error measurement compares the received signal IQ modulation characteristics to an ideal signal to determine the composite vector error magnitude. The histogram is calculated over a one hour period.
Link Loss	The link loss measurement is calculated as follows: Peer_Tx_Power (dBm) – Local_Rx_Power (dBm) + 2 x Antenna_Pattern (dBi) The histogram is calculated over a one hour period.
Signal Strength Ratio	The Signal Strength Ratio is: Power received by the vertical antenna input (dB) ÷ Power received by the horizontal antenna input (dB) This ratio is presented as: max, mean, min, and latest in an histogram format. The max, min and latest are true instantaneous measurements; the mean is the mean of a set of one second means. See Histogram data on page 7-21.
Transmit Data Rate	The data rate in the transmit direction, expressed in Mbps and presented as: max, mean, min, and latest in an histogram format. The max, min and latest are true instantaneous measurements; the mean is the mean of a set of one second means. Expected data rates can be found in Data rate calculations on page 4-114.

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Attribute	Meaning
Receive Data Rate	The data rate in the receive direction, expressed in Mbps and presented as: max, mean, min, and latest in an histogram format. The max, min and latest are true instantaneous measurements; the mean is the mean of a set of one second means. Expected data rates can be found in Data rate calculations on page 4-114
Aggregate Data Rate	The sum of the data rate in the directions expressed in Mbps and presented as: max, mean, min, and latest in an histogram format. The max, min and latest are true instantaneous measurements; the mean is the mean of a set of one second means. Expected data rates can be found in Data rate calculations on page 4-114.
Histogram Measurement Period	The time over which the system histograms were collected.

Signal Strength Ratio is an aid to debugging a link. If it has a large positive or negative value then investigate the following potential problems:

- An antenna coaxial lead may be disconnected.
- When spatial diversity is employed, the antenna with the lower value may be pointing in the wrong direction.
- When a dual polar antenna is deployed, the antenna may be directed using a side lobe rather than the main lobe.

When there is a reflection from water on the link and spatial diversity is employed, then one expects large, slow swings in Signal Strength Ratio. This indicates the antenna system is doing exactly as intended.

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System counters

The System Statistics page contains the following system counters:

- Data port counters (Table 7-14)
- Management port counters (Table 7-15)
- Wireless port counters and performance information (Table 7-16)

The packet counter attributes each contain a number in parentheses; this shows the number of packets received since the last page refresh.

To reset all system counters to zero, select **Reset System Counters**.

Table 7-14 Data Port Counter attributes in the System Statistics page

Attribute	Meaning
Ethernet Tx Packets	This displays the total number of good packets the bridge has sent for transmission by the local Ethernet interface.

Table 7-15 Management Port Counter attributes in the System Statistics page

Attribute	Meaning
Packets To Internal Stack	This displays the total number of good packets the bridge has transmitted to the internal stack (for example, ARP requests, PING requests, HTTP requests).
Packets From Internal Stack	This displays the total number of good packets the bridge has received from the internal stack (for example ARP responses, PING replies, HTTP responses).

Table 7-16 Wireless Port Counter attributes in the System Statistics page

Attribute	Meaning
Wireless Tx Packets	This displays the total number of good packets the bridge has sent for transmission by the wireless interface.
Wireless Rx Packets	This displays the total number of good packets the bridge has received from the wireless interface.

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Attribute	Meaning
Link Symmetry	A ratio that expresses the division between transmit and receive time in the TDD frame. The first number in the ratio represents the time allowed for the transmit direction and the second number represents the time allowed for the receive direction.
Link Capacity	The maximum aggregate data capacity available for user traffic under the current radio link conditions, assuming the units have been connected using Gigabit Ethernet. The sum of the displayed Transmit and Receive data rates may be lower than this figure if the link isn't fully loaded by the current traffic profile.
Transmit Modulation Mode	The modulation mode currently being used on the transmit channel. The number in brackets after the modulation mode and coding rate string is the effective data rate available to all MAC layer protocols. List of all the modulation modes can be found in Data rate calculations on page 4-114, where data rate calculations plots are given for each available modulation mode.
Receive Modulation Mode	The modulation mode currently being used on the receive channel. The number in brackets after the modulation mode and coding rate string is the effective data rate available to all MAC layer protocols. List of all the modulation modes can be found in Data rate calculations on page 4-114, where data rate calculations plots are given for each available modulation mode.
Receive Modulation Mode Detail	This supplies the user with information regarding the receive modulation mode in use. Possible values are: ‘Running at maximum receive mode’ ‘Running at user-configured Target Modulation Mode’ ‘Restricted because Installation is armed’ ‘Restricted because of byte errors on the wireless link’ ‘Restricted because a DFS channel change is in progress’ ‘Restricted due to the low Ethernet link speed’ ‘Limited by the radio conditions’

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Attribute	Meaning
Wireless Link Availability	Expresses the link availability as a percentage of time since the first successful registration after a system restart, expressed as a percentage to four decimal places.
Byte Error Ratio	The ratio of detected Byte errors to the total number of bytes since the last system reboot. This is a true measure of link quality as this measurement is made continually using null frames when there is no user data to transport.
Counter Measurement Period	The time over which the system counters were collected. NOTE

Other attributes

The System Statistics page contains two other attributes (Table 7-17).

After updating the Statistics Page Refresh Period field, select **Submit Page Refresh Period**.

Table 7-17 Other attributes in the System Statistics page

Attribute	Meaning
Elapsed Time Indicator	Elapsed time since the last system reboot.
Statistics Page Refresh Period	The statistics page refreshes automatically according to the setting entered here (in seconds).

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Resetting system histograms and counters

To reset system histograms and counters, proceed as follows:

Procedure 7-4 Reset system histograms and counters

1	Select menu option **System, Statistics**. The System Statistics page is displayed (Figure 7-17).
2	To reset the System Histograms attributes, select **Reset System Histogram Measurement Period**.
3	To reset the Counters attributes, select **Reset System Counters**.

Checking detailed counters

The Detailed Counters page displays detailed statistics of the Ethernet Bridge and the underlying wireless performance.

The Detailed Counters page is subdivided into two columns. Column one presents the detailed statistics for the bridge's Ethernet interface. Column two relates to the wireless interface.

To check detailed counters, proceed as follows:

Procedure 7-5 Check system statistics and counters

1	Select menu option **System, Statistics, Detailed Counters**. The Detailed Counters page is displayed (Figure 7-18).
2	Review the detailed counters (Table 7-18).

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Figure 7-18 Detailed Counters page

Detailed Counters

Ethernet			Wireless		
Attributes	**Value**	**Units**	**Attributes**	**Value**	**Units**
Ethernet Rx Octets	0 (+0)		Wireless Rx Octets	55,012 (+55,012)	
Ethernet Tx Octets	0 (+0)		Wireless Tx Octets	349,490 (+349,490)	
Ethernet Rx Drops	0 (+0)		Wireless Rx Drops	0 (+0)	
Ethernet Rx Packets	0 (+0)		Wireless Rx Packets	598 (+153)	
Ethernet Rx Broadcasts	0 (+0)		Wireless Rx Broadcasts	106 (+106)	
Ethernet Rx Multicasts	0 (+0)		Wireless Rx Multicasts	0 (+0)	
Ethernet Rx Crc And Align	0 (+0)		Wireless Rx Crc And Align	0 (+0)	
Ethernet Rx Undersize	0 (+0)		Wireless Rx Undersize	0 (+0)	
Ethernet Rx Oversize	0 (+0)		Wireless Rx Oversize	0 (+0)	
Ethernet Rx Fragments	0 (+0)		Wireless Rx Fragments	0 (+0)	
Ethernet Rx Jabbers	0 (+0)		Wireless Rx Jabbers	0 (+0)	
Ethernet Rx 64 Bytes	0 (+0)		Wireless Rx 64 Bytes	524 (+524)	
Ethernet Rx 65 To 127 Bytes	0 (+0)		Wireless Rx 65 To 127 Bytes	46 (+46)	
Ethernet Rx 128 To 255 Bytes	0 (+0)		Wireless Rx 128 To 255 Bytes	1 (+1)	
Ethernet Rx 256 To 511 Bytes	0 (+0)		Wireless Rx 256 To 511 Bytes	28 (+28)	
Ethernet Rx 512 To 1023 Bytes	0 (+0)		Wireless Rx 512 To 1023 Bytes	16 (+16)	
Ethernet Rx 1024 To Max Bytes	0 (+0)		Wireless Rx 1024 To Max Bytes	0 (+0)	
Ethernet Tx Drops	803 (+803)		Wireless Tx Drops	1 (+1)	
Ethernet Tx Packets	0 (+0)		Wireless Tx Packets	803 (+285)	
Ethernet Tx Broadcasts	0 (+0)		Wireless Tx Broadcasts	0 (+0)	
Ethernet Tx Multicasts	0 (+0)		Wireless Tx Multicasts	0 (+0)	
Ethernet Tx Collisions	0 (+0)		Wireless Tx Collisions	0 (+0)	
Ethernet Tx 64 Bytes	0 (+0)		Wireless Tx 64 Bytes	254 (+254)	
Ethernet Tx 65 To 127 Bytes	0 (+0)		Wireless Tx 65 To 127 Bytes	153 (+153)	
Ethernet Tx 128 To 255 Bytes	0 (+0)		Wireless Tx 128 To 255 Bytes	92 (+92)	
Ethernet Tx 256 To 511 Bytes	0 (+0)		Wireless Tx 256 To 511 Bytes	37 (+37)	
Ethernet Tx 512 To 1023 Bytes	0 (+0)		Wireless Tx 512 To 1023 Bytes	98 (+98)	
Ethernet Tx 1024 To Max Bytes	0 (+0)		Wireless Tx 1024 To Max Bytes	194 (+194)	
Ethernet Tx Fifo Drops	0 (+0)		Wireless Tx Fifo Drops	0 (+0)	
Ethernet Rx Pause Frames	0 (+0)		Wireless Rx Pause Frames	0 (+0)	
Ethernet Tx Pause Frames	0 (+0)		Wireless Tx Pause Frames	0 (+0)	
Ethernet Rx Classified Drops	0 (+0)		Wireless Rx Classified Drops	0 (+0)	
Ethernet Rx Frames Q0	0 (+0)		Wireless Tx Frames Q0	0 (+0)	
Ethernet Rx Frames Q1	822 (+822)		Wireless Tx Frames Q1	822 (+822)	
Ethernet Rx Frames Q2	0 (+0)		Wireless Tx Frames Q2	0 (+0)	
Ethernet Rx Frames Q3	0 (+0)		Wireless Tx Frames Q3	0 (+0)	
Ethernet Rx Frames Q4	0 (+0)		Wireless Tx Frames Q4	0 (+0)	
Ethernet Rx Frames Q5	0 (+0)		Wireless Tx Frames Q5	0 (+0)	
Ethernet Rx Frames Q6	0 (+0)		Wireless Tx Frames Q6	0 (+0)	
Ethernet Rx Frames Q7	0 (+0)		Wireless Tx Frames Q7	0 (+0)	
Ethernet Tx Frames Q0	655 (+655)		Wireless Rx Frames Q0	655 (+655)	
Ethernet Tx Frames Q1	0 (+0)		Wireless Rx Frames Q1	0 (+0)	
Ethernet Tx Frames Q2	0 (+0)		Wireless Rx Frames Q2	0 (+0)	
Ethernet Tx Frames Q3	0 (+0)		Wireless Rx Frames Q3	0 (+0)	
Ethernet Tx Frames Q4	0 (+0)		Wireless Rx Frames Q4	0 (+0)	
Ethernet Tx Frames Q5	0 (+0)		Wireless Rx Frames Q5	0 (+0)	
Ethernet Tx Frames Q6	0 (+0)		Wireless Rx Frames Q6	0 (+0)	
Ethernet Tx Frames Q7	0 (+0)		Wireless Rx Frames Q7	0 (+0)	
Internal Stack					
Packets To Internal Stack	676 (+230)				
Packets From Internal Stack	898 (+366)				
Packets Ignored By Internal Stack	0 (+0)				
Detailed Counters Page Refresh Period	3600	Seconds	Update Page Refresh Period	Reset System Counters	

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Table 7-18 Detailed Counters attributes

Attribute	Meaning
Tx & Rx Octets	Total number of octets (bytes) transmitted or received over the interface.
Rx Drops	Total number of frames dropped due to the lack of sufficient capacity in the receive buffer.
Rx Packets	Total number of packets received by the interface. This includes both good and bad packets.
Rx Broadcasts	Total number of good broadcast packets.
Rx Multicasts	Total number of good multicast packets.
Rx CRC and Align	Total number of packets with CRC or frame alignment errors.
Rx Undersize	Total number of packets received that are less than 64 bytes and have a valid CRC.
Rx Oversize	Total number of packets received that are greater than the maximum number of bytes with a valid CRC.
Rx Fragments	Total number of packets that are less than 64 bytes with an invalid CRC (these packet types are also known as runts).
Rx Jabbers	Total number of packets received that are greater than the maximum number of bytes with an invalid CRC.
Rx 64 Bytes	Total number 64 byte frames received.
Rx 65 to 127 Bytes	Total number of frames received in the size range 65 to 127 bytes.
Rx 128 to 255 Bytes	Total number of frames received in the size range 128 to 255 bytes.
Rx 256 to 511 Bytes	Total number of frames received in the size range 256 to 511 bytes.
Rx 512 to 1023 Bytes	Total number of frames received in the size range 512 to 1023 bytes.
Rx 1024 to Max	Total number of frames received in the size range 1024 to Maximum bytes.
Tx Drops	Total number of frames dropped due excessive collisions, late collision and frame ageing.

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Attribute	Meaning
Tx Packets	Total number of packets received by the interface. This includes both good and bad packets.
Tx Broadcasts	Total number of good broadcast packets.
Tx Multicasts	Total number of good multicast packets.
Tx Collisions	Total number frames experiencing collisions.
Tx 64 Bytes	Total number 64 byte frames transmitted.
Tx 65 to 127 Bytes	Total number frames transmitted in the size range 65 to 127 bytes.
Tx 128 to 255 Bytes	Total number frames transmitted in the size range 128 to 255 bytes.
Tx 256 to 511 Bytes	Total number frames transmitted in the size range 256 to 511 bytes.
Tx 512 to 1023 Bytes	Total number frames transmitted in the size range 512 to 1023 bytes.
Tx 1024 to Max	Total number frames transmitted in the size range 1024 to Maximum bytes.
Tx FIFO Drops	Total number frames dropped due to lack of capacity in the transmit buffer, for example when the PTP 600 Series is connected to the local Ethernet at a connection speed of less than 1 Gbps.
Rx & Tx Frames Q0…Q7	Total number of received or transmitted frames for each Traffic Class (Q0 to Q7).
Rx & Tx Pause Frames	Total number of received or transmitted pause frames (Ethernet interface only).
Packets To Internal Stack	The total number of good packets the bridge has transmitted to the internal stack.
Packets From Internal Stack	The total number of good packets the bridge has received from the internal stack.
Packets Ignored By Internal Stack	The total number of bad packets the bridge has transmitted to the internal stack.
Rx Classifier Drops	Total number of received frames dropped due to the application of classifier rules.

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Attribute	Meaning
Detailed Counters Page Refresh Period	The statistics page refreshes automatically according to the setting entered here (in seconds).

Using the diagnostics plotter

The diagnostics plotter can trace the following statistics (refer to Table 7-13 for definitions):

- Vector Error
- Rx Power
- Tx Power
- Signal Strength Ratio V/H
- Link Loss
- Rx Data Rate
- Tx Data Rate
- Aggregate Data Rate

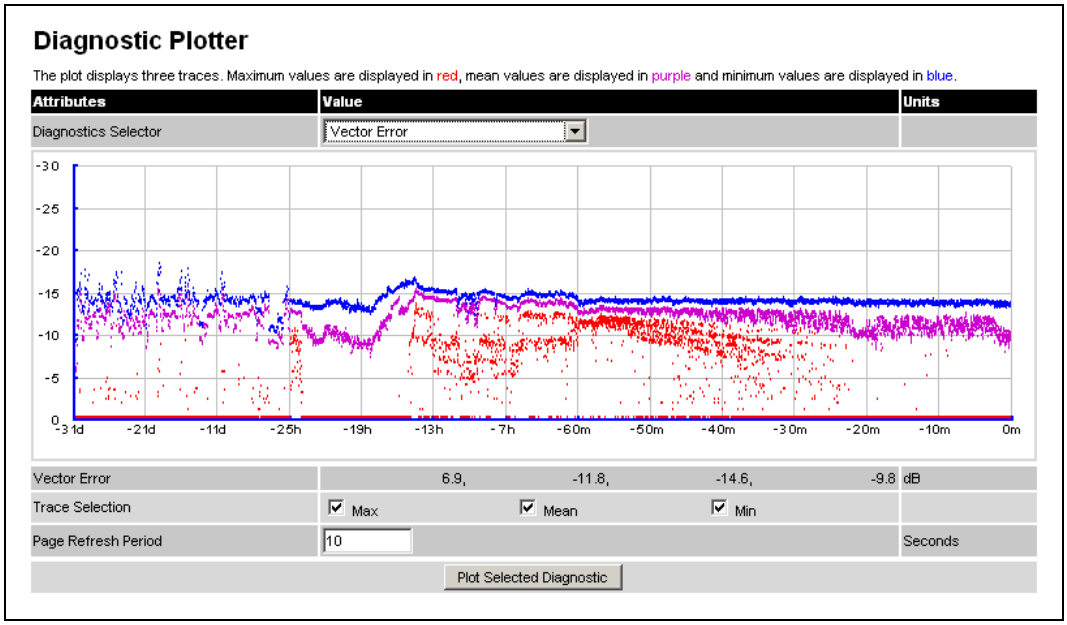
To plot diagnostics, proceed as follows:

Procedure 7-6 Plot diagnostics

1	Select menu option **System, Diagnostics Plotter**. The Diagnostics Plotter page is displayed (Figure 7-19).
2	Use the Diagnostics Selector drop-down list to select a diagnostic type to plot.
3	Use the Trace Selection to select traces of the maximum, mean or minimum values of the diagnostic type. Maximum values are displayed in red, mean values are displayed in purple and minimum values are displayed in blue.
4	Select **Plot Selected Diagnostic**. The trace is displayed in the graph.

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Figure 7-19 Diagnostic Plotter page



Changing the diagnostics refresh period

The default refresh period is 3600 seconds (1 hour). If a much shorter refresh period is selected, for example 60 seconds, it is possible to monitor the performance of an operational PTP 600 link in real time.

To change the diagnostics refresh period, proceed as follows:

Procedure 7-7 Change the diagnostics refresh period

1	Select menu option **System, Diagnostics Plotter**. The Diagnostics Plotter page is displayed (Figure 7-19).
2	Enter the required refresh frequency in the Page Refresh Period attribute.

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Downloading diagnostic data

The CSV file contains at most 5784 entries, recorded over a 32 day period:

- 3600 entries recorded in the last hour.
- 1440 entries recorded in the previous 24 hours.
- 744 entries recorded in the previous 31 days.

The following statistics can be downloaded (refer to Table 7-13 for definitions):

- Vector Error
- Rx Power
- Tx Power
- Signal Strength Ratio V/H
- Link Loss
- Rx Data Rate
- Tx Data Rate
- Aggregate Data Rate

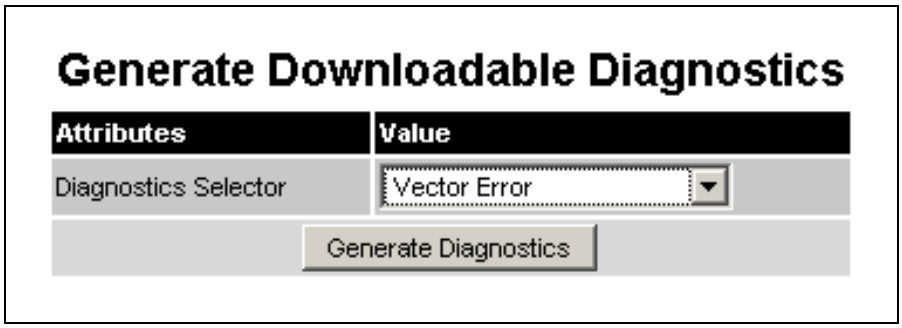
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To download diagnostics data, proceed as follows:

Procedure 7-8 Download diagnostics

1	Select menu option **System, Diagnostics Plotter, CSV Download**. The Generate Downloadable Diagnostics page is displayed (Figure 7-20).
2	Use the Diagnostics Selector drop-down list to select a diagnostic type to download.
3	Select **Generate Diagnostics**. The Generate Downloadable Diagnostics page is redisplayed with the name of the generated CSV file.
4	Click on the CSV file name and select Save File. Save the CSV file to the hard drive of the local computer.
5	Open the CSV file in MS Excel and use it to generate statistical reports and diagrams.

Figure 7-20 Generate Downloadable Diagnostics page



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Rebooting the unit

To reboot the ODU or view a list of previous reboot reasons, proceed as follows:

Procedure 7-9 Reboot the ODU or view reboot reasons

1	Select menu option **System, Reboot**. The Reboot Wireless Unit page is displayed (Figure 7-21).
2	Use the drop-down list to view the Previous Reasons For Reset/Reboot.
3	If a reboot is required, select **Reboot Wireless Unit**. The Reboot Confirmation dialog is displayed (Figure 7-22).
4	Select **OK**. The reboot progress message is displayed. On completion, the unit restarts.

Figure 7-21 Reboot Wireless Unit page

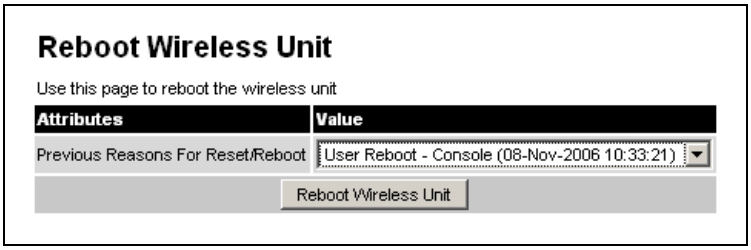
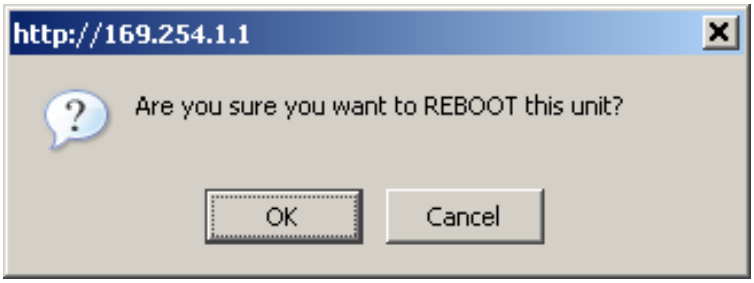


Figure 7-22 Reboot confirmation pop up



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Chapter 8 Troubleshooting

This section provides instructions for identifying and correcting faults in a PTP 600 link.

Perform the following procedures either on a newly installed link, or on an operational link if communication is lost:

- Test the hardware at each end of the link, as described in Test link end hardware on page 8-2.
- Test the radio link, as described in Test radio link on page 8-16.
- If an installation has been struck by lightning, see Lightning strike on page 8-18.
- If PTP-SYNC is installed but is not working correctly, see PTP-SYNC fault finding guide on page 8-19.
- If an ODU has entered recovery mode, see Using recovery mode on page 8-21.
- If the configuration files needs to be restored, see Restoring the configuration file on page 8-28.

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Test link end hardware

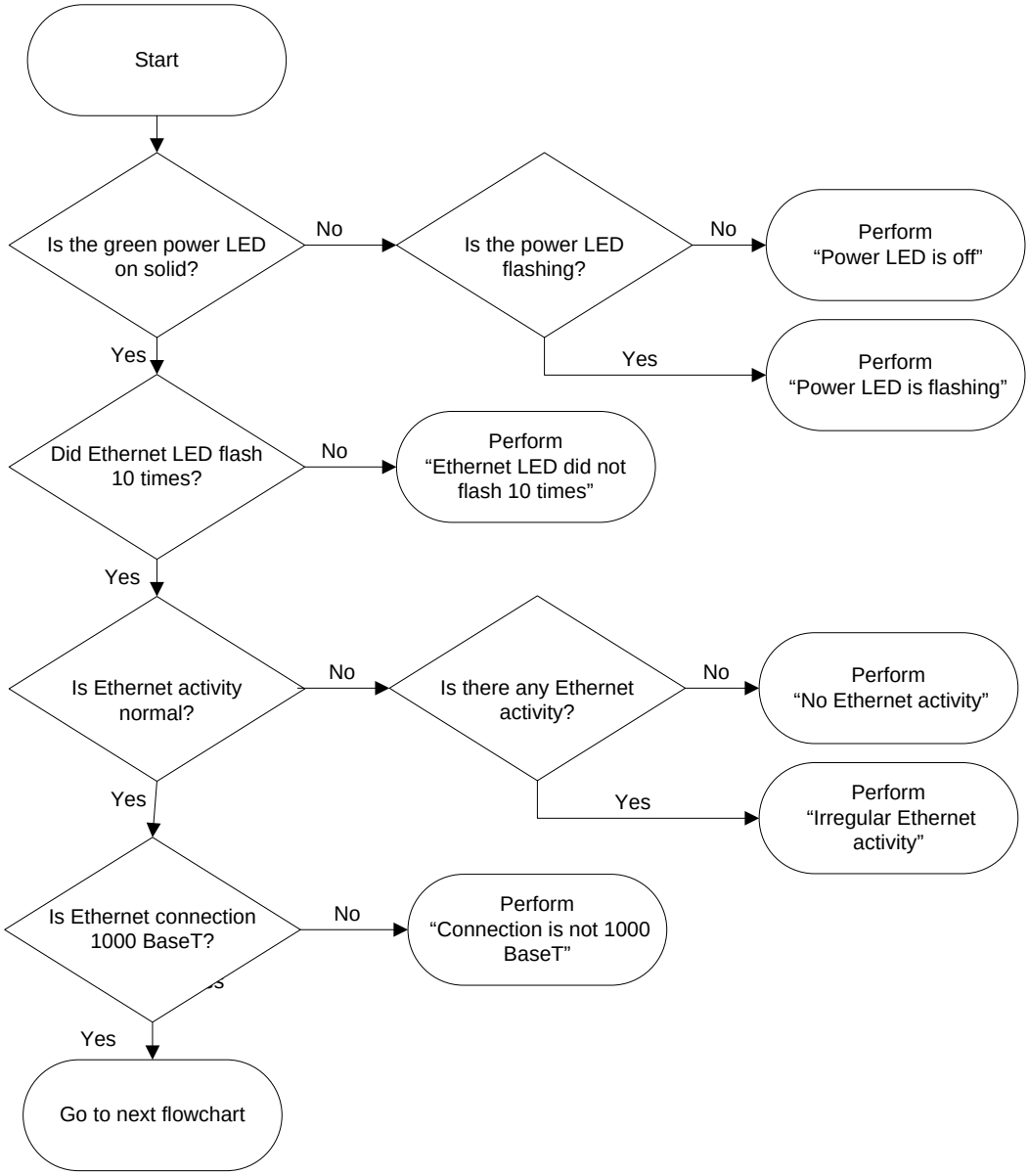
Before testing link end hardware, confirm that all outdoor drop cables, that is those that connect the ODU or GPS receiver (if installed) to equipment inside the building, are of the supported type, as defined in Cable and connector specificationson page 4-16.

If the Power and Ethernet LEDs do not illuminate correctly during the start-up sequence, test the link end as described in the flowchart (Figure 8-1) and detailed test procedures that follow.

If a UltraSync GPS synchronization unit has been installed, but one or more of its status LEDs are not illuminated, refer to Test UltraSync GPS receiver on page 8-15.

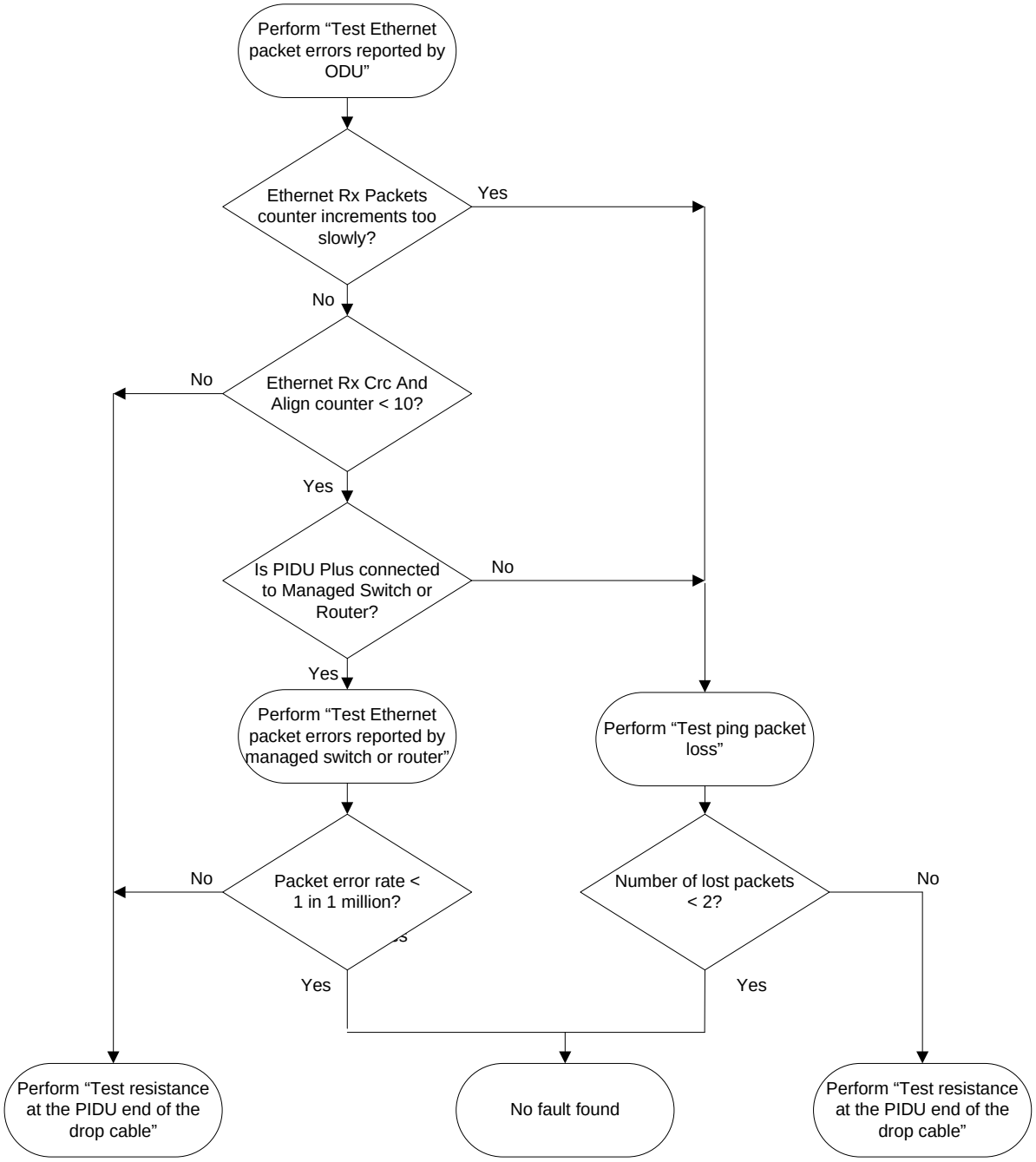
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Figure 8-1 Link end hardware test flowchart #1



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Figure 8-2 Link end hardware test flowchart #2



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Power LED is off

If the Power LED is not on solid or flashing, proceed as follows:

Procedure 8-1 Test the power supply

1	Remove the power lead from the PIDU Plus.
2	Test that the power supply (mains or 56 V battery) is working.
3	If the power supply is not working, investigate the cause.

If the power supply is working, proceed as follows:

Procedure 8-2 Remove ODU cable from PIDU Plus

1	Open the flap on the left hand side of the PIDU Plus.
2	Remove the ODU cable from the PIDU Plus.
3	Observe the effect on the Power LED; does it illuminate?

If the Power LED does not illuminate when the ODU cable is removed, proceed as follows:

Procedure 8-3 Power LED does not illuminate when ODU cable is removed

1	Measure the voltage across the +55 V and 0 V pads inside the PIDU Plus flap. If the voltage is incorrect, it indicates that the PIDU Plus is short-circuited. Report a suspected PIDU Plus fault to Motorola.
2	Measure the impedance across the Power connector. If the impedance is incorrect, it indicates that the PIDU Plus is short-circuited. Report a suspected PIDU Plus fault to Motorola.
3	If both of the above tests produce correct readings, it is likely that the PIDU Plus Power LED is faulty. Report a suspected PIDU Plus fault to Motorola.

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If the Power LED does illuminate when the ODU cable is removed, proceed as follows:

Procedure 8-4 Power LED does illuminate when ODU cable is removed

1	Remove the jumper (J905) found inside the PIDU Plus flap.
2	Measure the current with an ammeter placed across the two jumper pins. It should be 10 mA with the ODU disconnected. If the ammeter reading is incorrect, report a suspected PIDU Plus fault to Motorola.

If all tests so far have succeeded, proceed as follows:

Procedure 8-5 Other power tests

1	Reconnect the ODU cable to the PIDU Plus.
2	Measure the current with an ammeter placed across the two jumper pins. It should be in the range 300 mA to 1 A with the ODU connected.
3	If the ammeter reading is too high, the ODU may be drawing too much power, or the ODU may be short-circuited. Report a suspected ODU fault to Motorola.
4	If the ammeter reading is too low, the PIDU Plus may be supplying too little power. Report a suspected PIDU Plus fault to Motorola.

Power LED is flashing

If the green Power LED is flashing, proceed as follows:

Procedure 8-6 Power LED is flashing

1	Remove and examine the cable that connects the PIDU Plus to the LPU or ODU.
2	Check that pins 4&5 and 7&8 are not crossed with pins 1&2 and 3&6.
3	Check that the resistance between pins 1&8 is greater than 100K ohms.
4	If either check fails, replace or repair the cable that connects the PIDU Plus to the LPU or ODU.

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Ethernet LED did not flash 10 times

When the PIDU Plus is connected to the power supply and the green Power LED illuminates, there should be a 45 second delay, following which the yellow Ethernet LED should flash 10 times.

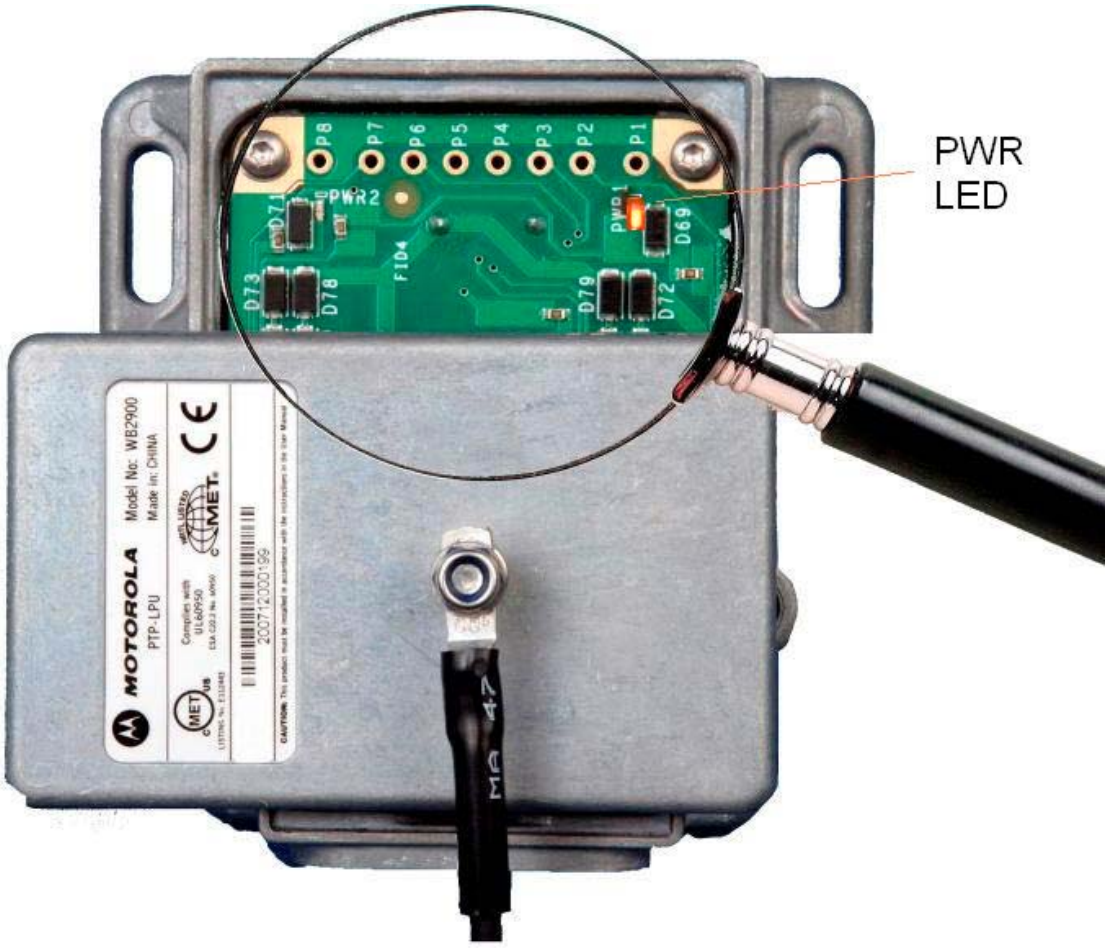
If the Ethernet LED did not flash 10 times, proceed as follows:

Procedure 8-7 Ethernet LED did not flash 10 times

1	Remove and examine the cable that connects the PIDU Plus to the LPU or ODU.
2	Check that the wiring to pins 4&5 and 7&8 is correct. For example, the wiring to pins 4 and 7 may be crossed.
3	Use the LPU (if installed) to check that power is available on the cable to the ODU. Access the connections by rotating the LPU lid as shown in Figure 8-3. Slacken the lid nut but do not remove it.
4	Test that test point P1 on the LPU PCB corresponds to pin 1 on the RJ45. Repeat for points P2 to P8.
5	Check that the PWR LED near the top right of the LPU PCB is illuminated to indicate power in the Ethernet cable (Figure 8-3).
6	If any test fails, replace or repair the cable that connects the PIDU Plus to the LPU or ODU.

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Figure 8-3 PTP LPU test points and PWR LED



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No Ethernet activity

If the Ethernet LED did flash 10 times but then went off, proceed as follows:

Procedure 8-8 Ethernet LED flashed 10 times then went out

1	Check that the RJ45 connection from the LAN port of the PIDU Plus to the PC is working.
2	If the PC connection is working, remove and examine the cable that connects the PIDU Plus to the LPU or ODU.
3	Check that the wiring to pins 1&2 and 3&6 is correct. For example, the wiring to pins 1 and 3 may be crossed.
4	If this test fails, replace or repair the cable that connects the PIDU Plus to the LPU or ODU.

Irregular Ethernet activity

The yellow Ethernet LED should blink randomly as normal traffic passes through. If the Ethernet LED flashes irregularly, for example there is a short flash followed by a long flash, this indicates that the ODU has booted in recovery mode. The causes may be installation wiring or a corrupt ODU software load. For more information, see Using recovery mode on page 8-21.

Connection is not 1000 BaseT

If the Ethernet connection to the network is only 10/100 BaseT, when 1000 BaseT is expected, proceed as follows:

Procedure 8-9 Connection is not 1000 BaseT

1	Remove and examine the cable that connects the PIDU Plus to the LPU or ODU.
2	Check that the wiring to pins 4&5 and 7&8 is correct. For example, the wiring to pins 4 and 7 may be crossed.
3	If this test fails, replace or repair the cable that connects the PIDU Plus to the LPU or ODU.

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Test Ethernet packet errors reported by ODU

To test for Ethernet packet errors, proceed as follows:

Procedure 8-10 Test for Ethernet packet errors

1	Log in to the ODU and select **Administration**, **Statistics**, **Detailed Counters**.
2	Select **Reset System Counters** at the bottom of the page and wait until the Ethernet Rx Packets counter has reached 1 million. **NOTE** The count will only update when the page is refreshed.
3	If the counter does not increment or increments too slowly, because for example the PTP 600 is newly installed and there is no offered Ethernet traffic, then abandon this procedure and consider using the procedure Test ping packet loss on page 8-11.
4	Check the Ethernet Rx Crc And Align counter. The test has passed if this is less than 10.

Test Ethernet packet errors reported by managed switch or router

If the PTP 600 is connected to a managed Ethernet switch or router, it may be possible to monitor the error rate of Ethernet packets. Please refer to the user guide of the managed network equipment.

The test has passed if the rate of packet errors reported by the managed Ethernet switch or router is less than 10 in 1 million packets.

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Test ping packet loss

Using a computer, it is possible to generate and monitor packets lost between the PIDU Plus and the ODU. This can be achieved by executing the Command Prompt application which is supplied as standard with Windows and MAC operating systems.

To test ping packet loss, proceed as follows:

Procedure 8-11 Test ping packet loss

1	Ensure that the IP address of the computer is configured appropriately for connection to the PTP 600 under test.
2	Ensure that the IP address of the computer does not clash with other devices connected to the network.
3	If the PIDU Plus is connected to an Ethernet switch or router then connect the computer to a spare port, if available.
4	If it is not possible to connect the computer to a spare port of an Ethernet switch or router, then the PIDU Plus will need to be disconnected from the network in order to execute this test. **⚠ CAUTION** The following steps will disrupt network traffic carried by the PTP 600 under test: Disconnect the PIDU Plus from the network. Connect the computer directly to the LAN port of the PIDU Plus.
5	On the computer, open the Command Prompt application.

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6	Send 1000 ping packets of length 1500 bytes. The process will take 1000 seconds, which is approximately 17 minutes. If the computer is running a Windows operating system, this is achieved by typing: **`ping –n 1000 –l 1500 <ipaddress>`** where <ipaddress> is the IP address of the PTP 600 ODU under test. If the computer is running a MAC operating system, this is achieved by typing: **`ping –c 1000 –s 1492 <ipaddress>`** where <ipaddress> is the IP address of the PTP 600 ODU under test.
7	Record how many Ping packets have been lost. This is reported by Command Prompt on completion of the test. The test has passed if the number of lost packets is less than 2.

Test resistance at the PIDU Plus end of the drop cable

If the above procedures fail to diagnose the issue, there may be a fault in the wiring of the drop cable that connects the ODU (or LPU) to the PIDU Plus. Perform this task to test the resistances between the RJ45 pins.

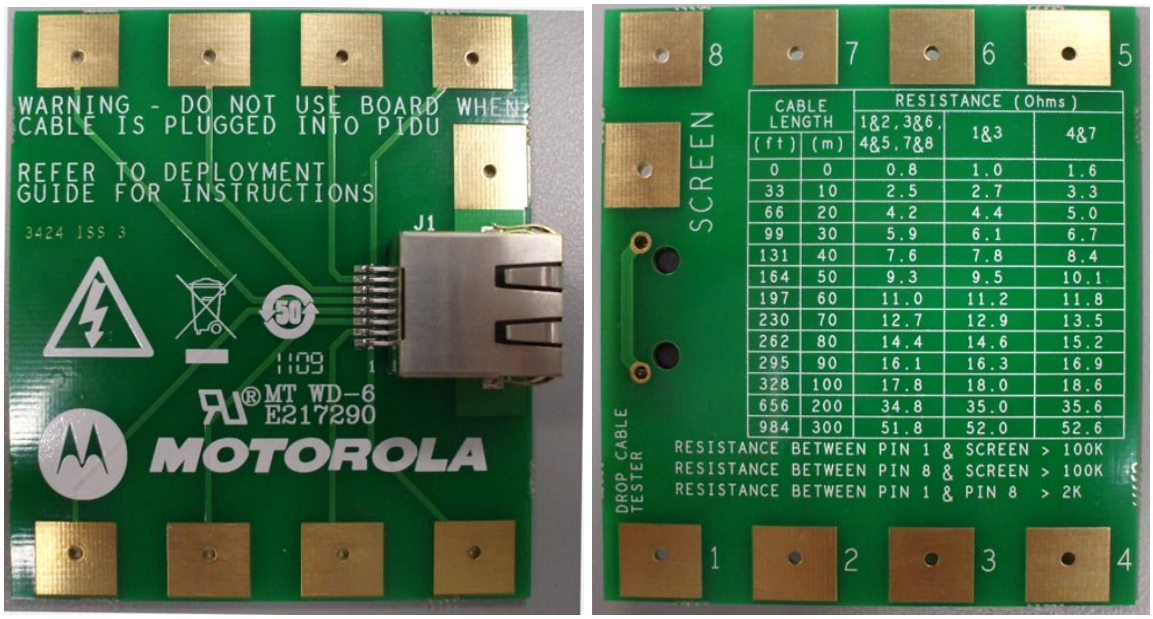
Use the PTP drop cable tester (Figure 8-4) to make testing easier. This can be ordered from http://www.motorola.com/ptp/support by selecting **Order Cable Tester** and completing the order form.

NOTE

The values printed on the PTP drop cable tester are example values and should only be used for guidance.

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Figure 8-4 Drop cable tester (front and back views)



If PTP-SYNC is not installed, unplug the drop cable from the ODU port of the PIDU Plus. If PTP-SYNC is installed, unplug the drop cable from the ODU OUT port of the PTP-SYNC unit. Connect the drop cable tester to the end of the drop cable. Then, perform the tests described in Table 8-1. Record the results in the Result column, if this is helpful.

Table 8-1 RJ45 cable resistance tests at the PIDU Plus end

Step	Test	Result
1	Measure the resistance between pins 1 and 2.	Ohms
2	Measure the resistance between pins 3 and 6.	Ohms
3	Measure the resistance between pins 4 and 5.	Ohms
4	Measure the resistance between pins 7 and 8.	Ohms
5	Ensure that all the results of steps 1 to 4 are within 10% of each other as follows: Take the minimum result and multiply by 1.1. If any of the remaining steps 1 to 4 results are greater than this, the test has failed.	PASS or FAIL

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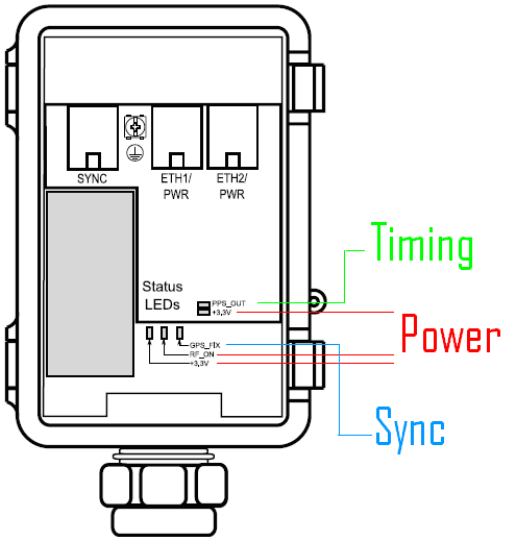
Step	Test	Result
6	Measure the resistance between pins 1 and 3. Subtract 0.2 Ohms.	Ohms
7	Measure the resistance between pins 4 and 7. Subtract 0.8 Ohms.	Ohms
8	Compare the results of steps 1 to 4 and steps 6 to 7 to the maximum allowed: If the cable is carrying Ethernet, then the maximum allowed is 20 Ohms. If the cable is carrying only power to the ODU (Ethernet over Fibre only), then the maximum allowed is 60 Ohms. If any of the steps 1 to 6 results are greater than the maximum allowed, the test has failed.	PASS or FAIL
9	Measure the resistance between pin 1 and the screen (ODU ground). If it is less than 100K ohms (regardless of cable length), the test has failed.	K Ohms PASS or FAIL
10	Measure the resistance between pin 8 and the screen (ODU ground). If it is less than 100K ohms (regardless of cable length), the test has failed.	K Ohms PASS or FAIL
11	Measure the resistance between pin 1 and pin 8: If UltraSync GPS is not fitted, and the resistance is less than 100K Ohms (regardless of cable length), the test has failed. If UltraSync GPS is fitted, and the resistance is less than 2K Ohms (regardless of cable length), the test has failed.	K Ohms PASS or FAIL

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Test UltraSync GPS receiver

The UltraSync GPS synchronization unit, if installed, is located between the ODU and the LPU. Use the status LEDs (Figure 8-5) to test the GPS unit.

Figure 8-5 GPS synchronization unit



To troubleshoot the UltraSync GPS synchronization unit, proceed as follows:

Procedure 8-12 Test the UltraSync

1	**Power supply**: Check that the **+3.3V** and **RF_ON** LEDs are lit, indicating that the GPS is receiving power. If they are not lit, confirm that all link end hardware (PIDU Plus, LPU, ODU and cabling) tests have been performed.
2	**Synchronization**: Approximately 2 minutes after powering on, the **GPS_FIX** LED should be lit. If it is not, ensure the GPS is at a height of at least 1.8m above the ground, where there is an unobstructed path to the sky.
3	**Timing**: When the GPS_FIX LED lights up, the **PPS_OUT** LED should begin blinking faintly at one pulse per second, indicating that sync is being generated. If does not, replace or repair the GPS synchronization unit.

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Test radio link

If the radio link is not working, or it is unreliable, or the data throughput rate is too low, perform the tests specified in this section. It may be necessary to test the ODUs at both ends of the link.

No activity

If there is no wireless activity, perform Procedure 8-13.

Procedure 8-13 Testing an inactive radio link

1	Check for Alarm conditions on Home page.
2	Check that the software at each end of the link is the same version.
3	Check that the Target Mac address is correctly configured at each end of the link.
4	Check Range.
5	Check Tx Power.
6	Check License keys to ensure that both units are the same product variant.
7	Check Master/Slave status for each unit and ensure that one unit is Master and the other unit is slave.
8	Check that the link is not obstructed or the ODU misaligned.
9	Check the DFS page at each end of the link and establish that there is a quiet wireless channel to use.
10	If there are no faults found in the configuration and there is absolutely no wireless signal, retry the installation procedure.
11	If this does not work then report a suspected ODU fault to Motorola.

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Some activity

If there is some activity but the link is unreliable or does not achieve the data rates required, perform Procedure 8-14.

Procedure 8-14 Testing a slow or unreliable radio link

1	Check that the interference has not increased using the i-DFS measurements.
2	If a quieter channel is available check that it is not barred.
3	Check that the path loss is low enough for the communication rates required.
4	Check that the ODU has not become misaligned.

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Lightning strike

If a link end installation is struck by lightning, perform Procedure 8-15.

Procedure 8-15 Testing a link end after lightning strike

1	Perform the tests specified in Test link end hardware on page 8-2.
2	Ensure that the PIDU Plus is working and that the resistances are correct as specified in Test resistance at the PIDU Plus on page 8-12.
3	If the ODU is not working, power off the ODU and both LPUs and return them to Motorola.
4	If the ODU is working but there is suspicion of damage to the LPU, then refer to *LPU Operational Troubleshooting (phn-1362)*.

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PTP-SYNC fault finding guide

Refer to Table 1-6 for descriptions of the PTP-SYNC LEDs.

LEDs do not illuminate

Ensure that there is a cable connection between the PIDU Plus ‘ODU’ interface and the ‘PIDU IN’ interface of the PTP-SYNC unit.

The ‘STATUS’ LED does not blink

This probably indicates that a 1PPS synchronization pulse is not detected by the PTP-SYNC unit (no satellite lock).

Depending on system configuration, take one of the following actions:

- System using a GPS receiver module - Ensure that there is a cable connection between the PTP-SYNC ‘GPS/SYNC IN’ interface and the LPU, also that there is a cable connection between the LPU and the GPS receiver module. Check that the GPS receiver module has an uninterrupted view of the sky.
- System using an alternative 1PPS timing source - Ensure that there is a cable connection between the PTP-SYNC ‘GPS/SYNC IN’ or ‘1PPS IN’ interface and the 1PPS timing source.
- On cluster slave units – Ensure that there is a cable connection between the slave GPS/SYNC IN interface and the SYNC OUT interface of the preceding unit in the chain.

The ‘ODU’ LED does not illuminate within 90 seconds of power-up

This probably indicates that there is no communication between PTP-SYNC and ODU

Ensure that the PTP-SYNC ‘ODU OUT’ interface is connected to the ODU (and LPUs if installed) via the drop cable .

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The ‘GPS’ LED does not illuminate or blink on clustered PTP-SYNC units

This indicates a fault only when the timing source is a GPS receiver.

Table 8-2 describes the action to be taken depending upon the behavior of the ‘GPS’ LEDs at the master and slave(s).

Table 8-2 Clustered PTP-SYNC units - ‘GPS’ LEDs Fault-finding

Cluster timing source	‘GPS’ LED on master	‘GPS’ LED on slave(s)	Diagnosis
GPS receiver providing NMEA data	Blink	Blink	OK
	Off	Any	Fault in GPS unit or GPS cable
	Blink	Off	Fault in daisy chain cable
Alternative 1PPS source, no NMEA data	Off	Off	OK
	Off	On	Fault in alternative 1PPS source
One ODU is cluster timing master	Off	Off	OK

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Using recovery mode

The Motorola PTP 600 point-to-point wireless Ethernet bridges have a special mode of operation that allows the user to recover a unit from configuration errors or software image corruption. This section describes how to enter recovery mode and how to recover the unit.

The following topics are described in this section:

- Entering recovery mode on page 8-21
- Selecting a recovery option on page 8-22
- Upgrading software image on page 8-24
- Resetting IP & Ethernet configuration on page 8-25
- Erasing configuration on page 8-26
- Rebooting the unit on page 8-27

Entering recovery mode

The unit may enter recovery mode automatically, in response to some failures.

To enter recovery mode manually, press the Recovery switch located on the underside of the PIDU Plus while applying mains power (Figure 8-6) , hold the Recovery switch in for between 10 and 20 seconds, then release it. The Ethernet LED will double-flash 10 times at power up.

Figure 8-6 PIDU Plus recovery switch location



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Selecting a recovery option

To select a recovery option when the unit is in recovery mode, proceed as follows:

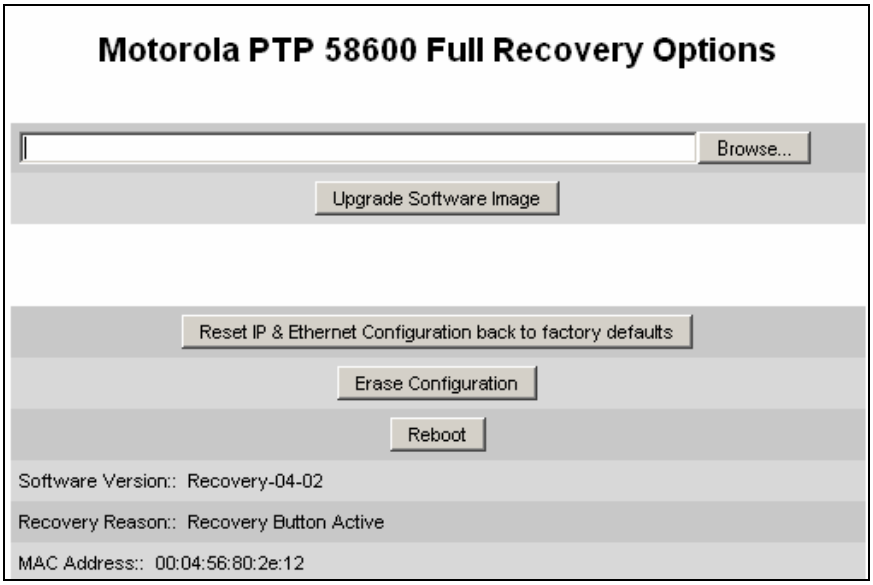
Procedure 8-16 Select a recovery option when in recovery mode

1	Access the web interface by entering the default IP address 169.254.1.1 (or 10.10.10.10). The Recovery Image Warning page is displayed (Figure 8-7).
2	Click on the warning page image. The Recovery Option Page is displayed (Figure 8-8).
3	Review the Software Version and Recovery Reason (Table 8-3).
4	Select a recovery option (Table 8-4).

Figure 8-7 Recovery Image Warning page



Figure 8-8 Recovery Options page



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Table 8-3 Recovery Options attributes

Attribute	Meaning
Software Version	The software version of the recovery operating system permanently installed during manufacture.
Recovery Reason	The reason the unit is operating in Recovery mode, for example 'Recovery button active' or 'Invalid or corrupt image'.
MAC Address	The MAC address shown here is the MAC address of the unit programmed during manufacture.

Table 8-4 Recovery Options buttons

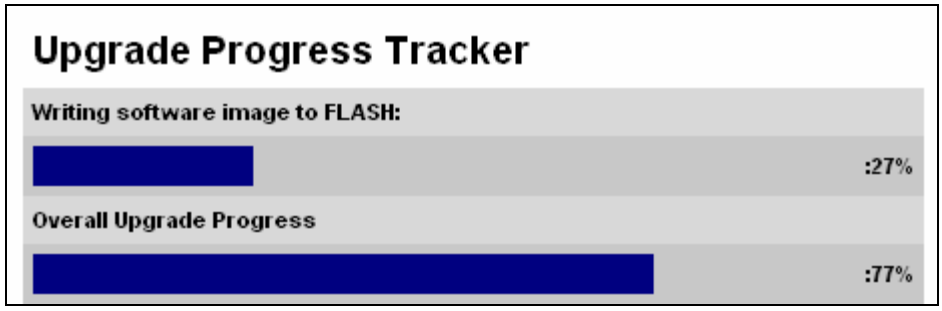
Button	Purpose
Upgrade Software Image	Use this option to restore a working software version when software corruption is suspected, or when an incorrect software image has been loaded. Refer to Upgrading software image on page 8-24.
Reset IP & Ethernet Configuration back to factory defaults	Use this option to restore the IP and Ethernet attributes to their defaults. Refer to Resetting IP & Ethernet configuration on page 8-25.
Erase Configuration	Use this option to erase the entire configuration of the unit. This will also erase factory settings such as target MAC address, range setting and license key. Refer to Erasing configuration on page 8-26.
Zeroise Critical Security Parameters	Use this option to reset encryption keys and the system administrator password. Refer to Zeroizing critical security parameters on page 7-40.
Reboot	Use this option to reboot the unit. Refer to Rebooting the unit on page 8-27.

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Upgrading software image

To restore a working software image from the Recovery Options page (Figure 8-8), proceed as follows:

Procedure 8-17 Upgrade software image when in recovery mode

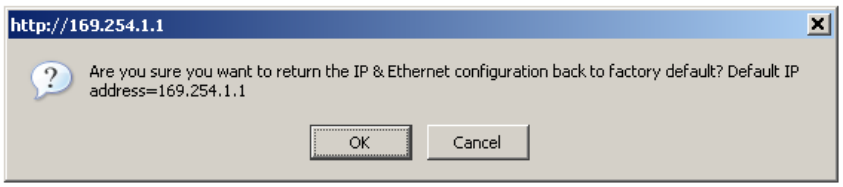
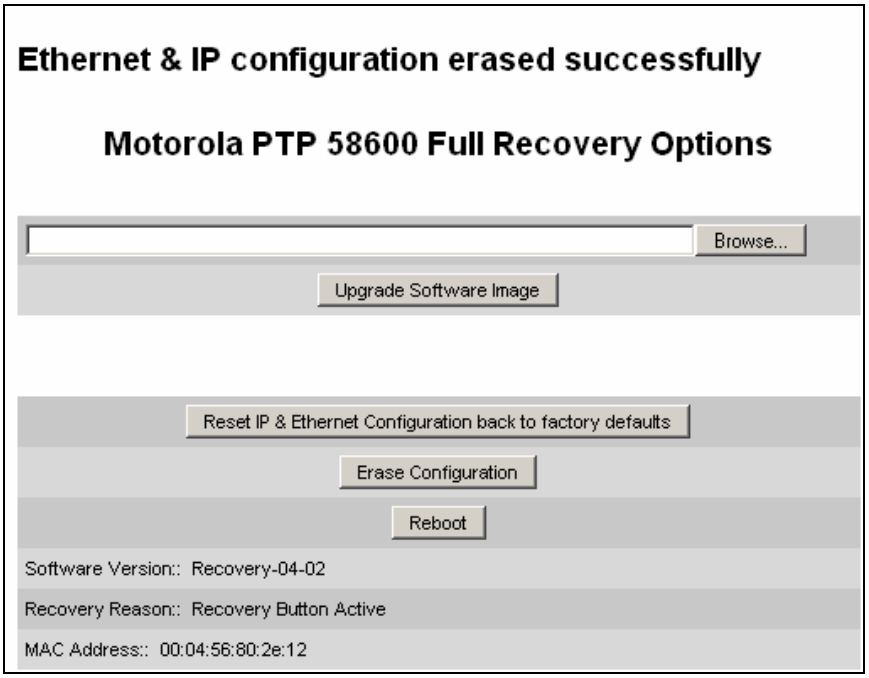
1	Select **Browse**.
2	Navigate to the required software image. This may be the most recent image if software corruption is suspected, or an older image if an incorrect image has just been loaded. Click on the image and select **OK**.
3	Select **Upgrade Software Image**. The Upgrade Progress Tracker page is displayed. 
4	When the Software Upgrade Complete page is displayed, check that the correct image has been downloaded. 
5	Select **Reboot Wireless Unit**. When the ‘Are you sure?’ pop up box is displayed, select **OK**.
6	The unit will now reboot. The unit should restart in normal operational mode and the link should recover. If the unit or link fails to recover, refer to Test link end hardware on page 8-2.

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Resetting IP & Ethernet configuration

To reset IP and Ethernet configuration back to factory defaults from the Recovery Options page (Figure 8-8) , proceed as follows:

Procedure 8-18 Reset IP and Ethernet configuration when in recovery mode

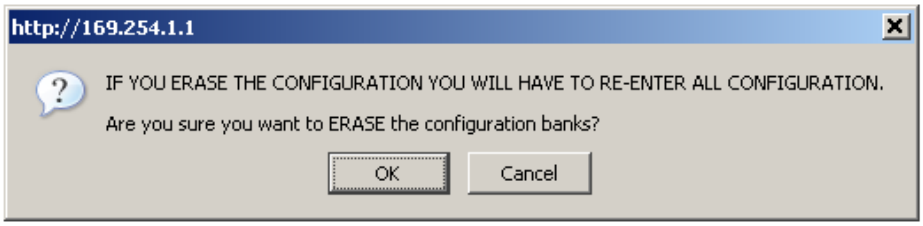
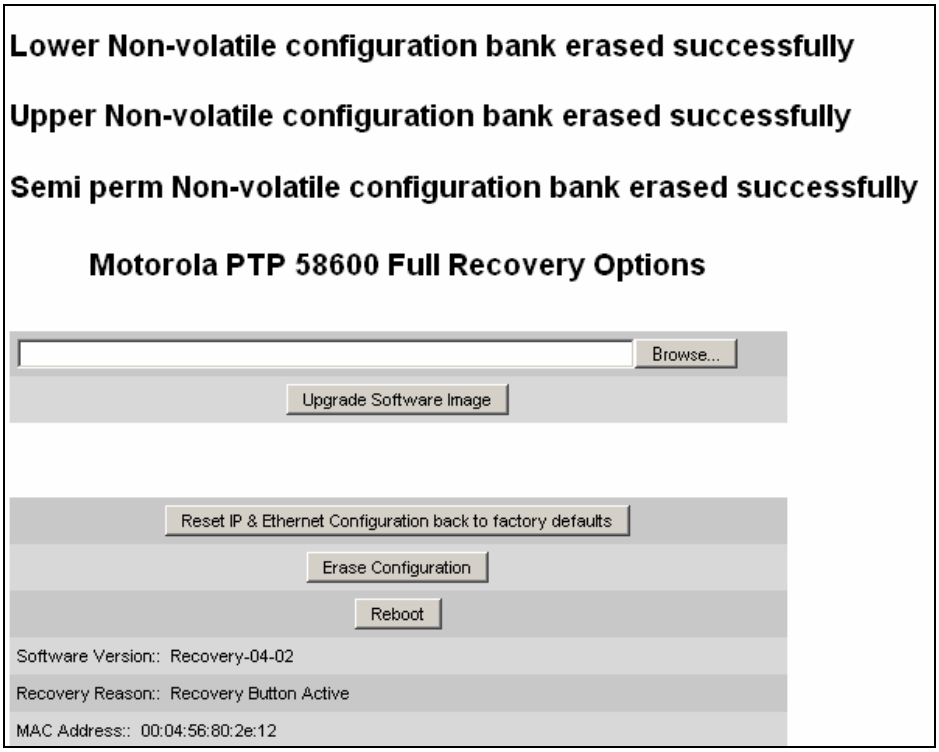
1	Select **Reset IP & Ethernet Configuration back to factory defaults**. The pop up box is displayed. Note the IP address that will be needed to log into the unit after recovery. 
2	Select **OK**. The confirmation pageis displayed. 
3	Select **Reboot**. When the 'Are you sure?' pop up box is displayed, select **OK**.
4	The unit will now reboot. The unit should now start up in normal mode but with the IP and Ethernet configuration reset to factory defaults. If the unit fails to recover, refer to Test link end hardware on page 8-2.

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Erasing configuration

To erase the entire configuration of the unit from the Recovery Options page (Figure 8-8) , proceed as follows:

Procedure 8-19 Reset IP and Ethernet configuration when in recovery mode

1	Select **Erase Configuration**. The pop up box is displayed. 
2	Select **OK**. The confirmation page is displayed. 
3	Select **Reboot**. When the 'Are you sure?' pop up box is displayed, select **OK**.
4	The unit will now reboot. The unit should now start up in normal mode but with all configuration erased. If the unit fails to start up, refer to Test link end hardware on page 8-2.

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Rebooting the unit

To reboot the unit from the Recovery Options page (Figure 8-8), select **Reboot**. When the 'Are you sure?' pop up box is displayed, select **OK**.

The unit will now reboot. The unit should now start up in normal operational mode. If the unit fails to start up, refer to Test link end hardware on page 8-2.

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Restoring the configuration file

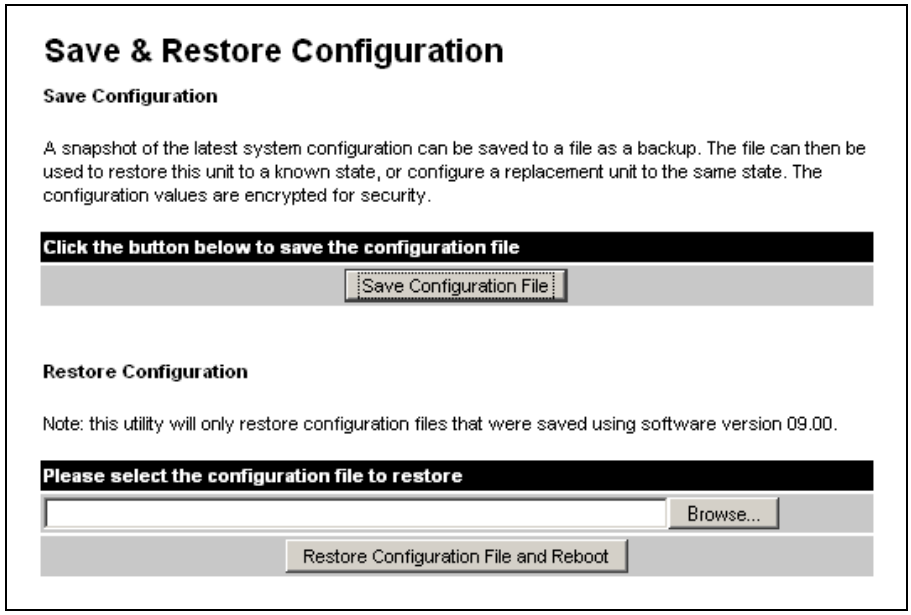
Perform this task to restore the operational configuration of the unit.

Before starting this task, ensure that:

- The configuration file of the old (faulty) unit has been saved.
- The new (replacement) unit has been installed.
- The license key of the old unit has been entered in the new unit.

To restore the configuration file, proceed as follows:

Procedure 8-20 Restore configuration file

1	From the left hand menu, select **Configuration**, **Save And Restore**. The Save & Restore Configuration page is displayed. 
2	Select **Browse** and navigate to the PC folder containing the saved configuration file (.cfg).
3	Select **Restore Configuration File and Reboot**.
4	Select **OK** to confirm the restore. The configuration file is uploaded and used to reconfigure the new unit to the same state as the old unit. On completion, the unit reboots.

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Glossary

Term	Definition
ARP	Address Resolution Protocol
ATPC	Automatic Transmit Power Control
BPSK	Binary Phase Shift Keying
CSP	Critical Security Parameter
DC	Direct Current
DER	Distinguished Encoding Rules
DFS	Dynamic Frequency Selection
EIRP	Equivalent Isotropic Radiated Power
ETSI	European Telecommunications Standards Institute
FAQ	Frequently Asked Question
FIPS	Federal Information Processing Standard
GPS	Global Positioning System
HTTP	Hypertext Transfer Protocol
ID	Identity
IEEE	Institute of Electrical and Electronic Engineers
IP	Internet Protocol
ISM	Industrial Scientific and Medical
ITPE	Initial Transmit Power Estimate
LAN	Local Area Network
LOS	Line-of-Sight (clear line-of-sight, and Fresnel zone is clear)
LPU	Lightning Protection Unit
MAC	Medium Access Control Layer

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Term	Definition
MDI	Medium Dependent Interface
MDIX	Medium Dependent Interface Crossover
MIB	Management Information Base
NLOS	Non-Line-of-Sight
NMEA	National Marine Electronics Association
ODU	Outdoor Unit
OFDM	Orthogonal Frequency Division Multiplex
PC	IBM Compatible Personal Computer
PIDU Plus	Powered Indoor Unit
PING	ICMP Echo Request
PTP	Point-to-Point
QAM	Quadrature Amplitude Modulation
RAM	Random Access Memory
RF	Radio Frequency
RSSI	Received Signal Strength Indication
SELV	Safety Extra Low Voltage
SMTP	Simple Mail Transport Protocol
SNMP	Simple Network Management Protocol
SNTP	Simple Network Time Protocol
STP	Shielded Twisted Pair
STP	Spanning Tree Protocol
TCP	Transmission Control Protocol
TLS	Transport Layer Security
URL	Universal Resource Location
UTP	Unshielded Twisted Pair
UV	Ultraviolet
VLAN	Virtual Local Area Network

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Index

1

1000 BaseT
not achieved, 8-9

A

Adaptive modulation
description, 1-28
Adaptive Modulation, 2-11
AES encryption
license, 1-52
Alarm, 7-8, 7-9
Alarms, 7-7
diagnostic, 6-104
supported, 2-40
system alarms, 7-8
Alignment, 6-73, 6-76
Antenna, 6-81
Antenna alignment, 5-2, 6-1
Antenna Restrictions
PTP 54600, 4-18
PTP 58600, 4-21
Antennas
aligning, 6-71

B

Band Edge Power Reduction, 4-58
Bandwidth, 2-5
Brackets, 1-9

C

Cable
Preparation, 5-3
Cable glands
connecting to ODU or LPU, 5-9
disconnecting, 5-11
Cable Loss, 6-59
Connectorized Variant, 4-97
Cables, 1-16, 1-17, 4-1, 4-3, 4-9, 4-16, 5-3, 8-2
for Antennas, 5-33
Certifications
EMC, 4-90
radio, 4-91
channel bandwidth
and OFDM, 1-26
Channel Bandwidth, 2-5
channels, 7-31
Channels
Barring, 7-25
History, 7-36
Clock, 6-83, 6-84, 7-5, 7-9
Compliance, 4-89, 4-90, 4-91
Conditions of Use, 3-3
Configuration, 1-43, 5-2, 6-1
confirmation of, 6-66
erasing, 8-26
interface, 6-51
Telecoms, 6-68
wireless, 6-54
Connecting, 5-29
at PIDU, 5-24
to network, 6-4
Connections
cables, 5-3
Counters
data port, 7-45
detailed counters page, 7-48
CSPs
zeroising, 7-40

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D

Data network, 4-76
Data Rates, 4-114
Deployment, 1-3, 5-2, 6-1
Description
  of PTP 600, 1-1
diagnostics, 7-21
Diagnostics, 6-104
  plotting, 7-52
  refresh period, 7-53
Dimensions, 4-12
Disarm, 6-80
Disarm ODU, 6-81
Disarming, 6-78
Disclaimer, 3-6
Drop cable
  grounding, 5-5
  resistance testing, 8-12

E

E1 installation, 5-49
E1/T1 links
  Telecoms Circuits, 1-41
Eire, 4-94
Email
  alerts and events, 1-52
  SMTP, 6-106
Email alerts, 4-81
Encryption key, 6-31
Entropy input, 6-30
Ethernet, 4-76
  activity, 8-9
  Configuration, 8-25
  LED did not flash, 8-7
  packet errors, 8-10
  Specifications, 4-76
Ethernet bridging
  description, 1-1, 1-36
Ethernet Connection, 1-10
Ethernet interface
  configuring, 6-2
ETSI, 4-92
EU Notification
  PTP 54600, 4-109
  PTP 58600, 4-111
Events, 4-82

F

Fault Finding, 8-1
Fault management, 6-106
FCC, 4-92
FCC Notification
  PTP 25600, 4-107
  PTP 49600, 4-108
  PTP 54600, 4-108
  PTP 58600, 4-110
Fiber optic connection, 1-10
FIPS
  encryption, 1-31
FIPS 140-2
  description, 1-56
Fixed Frequency, 7-30
Frequencies, 1-4
Frequency Variants, 1-5

G

Glossary, I
GPS
  installing Trimble, 5-42
  installing UltraSync, 5-34, 5-37
  mounting options, 2-32
  on building, 2-33
  on mast, 2-34
  protection of, 2-32
  testing UltraSync, 8-15
Graphical installation, 6-72
Grounding
  of drop cable, 5-5
  of GPS receiver, 5-47

H

Histogram, 7-21
Home page, 7-6
HTTP
  configuring, 6-110
  settings, 6-32

I

IC Notification
  PTP 49600, 4-108
  PTP 54600, 4-108
  PTP 58600, 4-110
i-DFS
  description, 1-29
Immunity, 4-90
Installation, 5-1
  graphical, 6-72
Interference, 4-93
IP
  configuration, 8-25

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IP interface
configuring, 6-2
IP traffic
and link mode optimization, 1-25

K

Key of keys, 6-27

L

Lateral Force, 2-8
LED
Ethernet, 8-7
power, 8-5, 8-6
LEDs
Remote, 1-15
Legal
Notices, 3-1
Liability, 3-24
license, 1-4
License Agreement, 3-2
License key
downgrade, 1-50
License keys
installing, 6-12
Licenses, 2-2, 4-36
Lightning, 1-16
Lightning protection
test after a strike, 8-18
Lightning Protection, 2-14, 5-18
Connectorized Variant, 5-30
PTP and, 1-16
Limits, 4-93
Link loss, 4-62
Link Loss, 2-13
Link mode optimization
description, 1-25
Link Planner, 2-10
for synchronized networks, 2-11
Link symmetry
description, 1-25

M

Management, 1-43
of faults, 6-106
of performance, 7-41
Master and Slave, 7-27
Measurements, 1-27
Menu bar, 7-3
Messages
event notification, 4-82
Metrics
Viewing, 7-37
MIBs
supported, 2-39
MIMO
description, 1-29
Modulation, 2-11
Mounting, 1-9
Connectorized Variant, 5-28
PIDU, 5-27

N

Network, 1-10
connecting the PIDU, 6-4
connecting to, 6-83
Networks
planning, 2-27
Notifications, 4-107

O

Obstacles, 2-10
ODU
alignment, 6-73
disarming, 6-80
mounting, 5-12
rebooting, 8-27
OfCom, 4-94
OFDM
and channel bandwidth, 1-26
Outdoor Unit (ODU)
Description, 1-7
Site Selection, 2-6
Output Power, 2-13

P

packet errors, 8-10
Password, 6-44
Passwords
configuring, 6-36
setting, 6-42
Path Loss, 2-11
Performance
checking, 6-82
Performance management, 7-41
PIDU
Description, 1-11

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Site Selection, 2-6, 2-7
Ping packets, 8-11
Planning, 2-1
of the PTP Link, 2-10
Power, 4-62
adjust transmit power, 6-82
Alternative Configurations, 1-13
LED is off, 8-5
testing for E1 and T1, 5-53
Power compliance margins, 4-100
Power density
calculation, 4-99
Power Output, 2-13
Power Supply, 4-14, 4-15, 4-26, 4-27, 4-28
Pre-installation checks, 5-2
Private key, 6-24, 6-25
Properties, 6-45
PTP 25600
Spectrum Management, 7-35
PTP Link Planner, 2-10
PTP-SYNC
fault finding, 8-19
front panel, 1-21
installing, 5-38
Public certificate, 6-24, 6-25

R

Radar avoidance, 1-30
radio, 4-92, 4-93, 4-105
Radio, 8-16
RADIUS
configuring, 6-87
description, 1-46
protocols and attributes, 4-79
Random number, 6-30
Range, 2-10
Range Adjustment, 4-128
Reboot, 8-27
Recovery, 8-21
Recovery mode
description, 1-54
Recovery Switch
Remote, 1-15
Reference Information, 4-1
Region codes, 4-36
Region Codes, 2-2
Regulations, 4-91
Connectorized Variant, 4-94
Examples, 4-93
Regulatory
Notices, 3-1
Regulatory Compliance
PTP 25600, 4-107
PTP 49600, 4-108
PTP 54600, 4-108
PTP 58600, 4-110
PTP 59600, 4-113
Regulatory limits, 4-102
Regulatory Notices, 4-1
Remote access
configuring, 6-110
Resetting configuration, 8-25
Resistances
E1/T1, 5-53
RJ45, 8-12
Restore configuration, 8-1, 8-28
RJ45
testing, 8-12
RJ45 Cable
Dressing, 5-27
RTTT, 2-4

S

Screens, 7-1
Security
commit configuration, 6-34
configuring, 6-21
critical parameters, 7-40
critical security parameters, 1-53
encryption, 1-31
hardware, 1-56
management procedures, 6-21
setting the banner, 6-29
SNMPv3, 1-47
transport layer, 1-44
SMTP, 6-106
SNMP, 6-90, 6-99, 7-5
configuring, 6-90
description, 1-46
SNMPv3
description, 1-47
MIB defaults, 4-77
Software
upgrading, 6-16, 7-38, 8-24
Spectrum
available settings, 4-44
Spectrum management, 7-22
Spectrum Management
Master and Slave, 7-22, 7-25
Spectrum Planning, 2-2
Standards
for RF equipment, 4-98

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Statistics, 7-41
resetting, 7-48
Status page, 7-11
Surge, 1-16
System Administration
password, 6-44
System logging
configuration, 6-1, 6-104, 6-108
messages, 4-82
syslog described, 1-51
System summary, 7-6

T

T1 installation, 5-49
TDD synchronization
configuration, 6-64
disarming, 6-81
options, 2-27
planning networks, 2-27
status, 7-19
TDM traffic
and link mode optimization, 1-25
Telecoms, 1-41, 4-76, 6-68
E1 and T1, 5-49
Telnet
configuring, 6-110
settings, 6-32
Testing
Hardware, 8-2
radio link, 8-16
TFTP
configuring, 6-110
upgrading software via, 7-38
Third Party Software, 3-8
Thresholds, 2-13, 4-62
Throughput, 4-114
Time division duplex (TDD)
description, 1-23
Tools, 5-28
Transmit power, 6-82
Transmit Power Reduction, 4-58
Troubleshooting, 8-1

U

Upgrades
capacity, 1-53
software, 1-54, 8-24
User accounts
configuring, 6-36
identity-based, 1-45, 6-42
User Interface, 7-1

V

VACM
defaults, 4-78
Variants, 1-5

W

Warning, 7-9, 7-10
Weather, 2-9
Weatherproofing, 5-29
Web interface, 7-3
Web Pages, 7-1
Webpage properties, 6-45
Weight, 4-12
Wind Loading, 2-7
Wireless interface
configuring, 6-46
Wireless settings, 6-54
Wireless specifications, 4-29

Z

Zones A and B, 2-15

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